UNITED STATES DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

EXPERIMENT STATION RECORD

VOLUME 61

JULY-DECEMBER, 1929

26 MAY 1936

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1930

U. S. DEPARTMENT OF AGRICULTURE

SECRETARY—A. M. Hyde

DIRECTOR OF SCIENTIFIC WORK—A. F. Woods

OFFICE OF EXPERIMENT STATIONS—W. H. Evans, *Acting Chief*

THE AGRICULTURAL EXPERIMENT STATIONS

ALABAMA—*Auburn:* M. J. Funchess.[1]
ALASKA—*Sitka:* H. W. Alberts.
ARIZONA—*Tucson:* E. D. Ball.[1]
ARKANSAS—*Fayetteville:* D. T. Gray.[1]
CALIFORNIA—*Berkeley:* C. B. Hutchison.[1]
COLORADO—*Fort Collins:* C. P. Gillette.[1]
CONNECTICUT—
State Station: *New Haven;* } W. L. Slate.[1]
Storrs Station: *Storrs;* }
DELAWARE—*Newark:* C. A. McCue.[1]
FLORIDA—*Gainesville:* W. Newell.[1]
GEORGIA—
Experiment: H. P. Stuckey.[1]
Coastal Plain Station: *Tifton;* S. H. Starr.[1]
GUAM—*Island of Guam:* C. W. Edwards.[1]
HAWAII—
Federal Station: *Honolulu;* J. M. Westgate.[1]
Pineapple Canners' Station: *Honolulu;* A. L. Dean.[1]
Sugar Planters' Station: *Honolulu;* H. P. Agee.[1]
IDAHO—*Moscow:* E. J. Iddings.[1]
ILLINOIS—*Urbana:* H. W. Mumford.[1]
INDIANA—*La Fayette:* J. H. Skinner.[1]
IOWA—*Ames:* C. F. Curtiss.[1]
KANSAS—*Manhattan:* L. E. Call.[1]
KENTUCKY—*Lexington:* T. P. Cooper.[1]
LOUISIANA—*Baton Rouge:* C. T. Dowell.[1]
MAINE—*Orono:* J. M. Bartlett.[2]
MARYLAND—*College Park:* H. J. Patterson.[1]
MASSACHUSETTS—*Amherst:* F. J. Sievers.[1]
MICHIGAN—*East Lansing:* V. R. Gardner.[1]
MINNESOTA—*University Farm, St. Paul:* W. C. Coffey.[1]
MISSISSIPPI—*A. and M. College:* J. R. Ricks.[1]
MISSOURI—
College Station: *Columbia;* F. B. Mumford.[1]
Fruit Station: *Mountain Grove;* F. W. Faurot.[1]
Poultry Station: *Mountain Grove;* T. W. Noland.[3]
MONTANA—*Bozeman:* F. B. Linfield.[1]
NEBRASKA—*Lincoln:* W. W. Burr.[1]
NEVADA—*Reno:* S. B. Doten.[1]
NEW HAMPSHIRE—*Durham:* J. C. Kendall.[1]
NEW JERSEY—*New Brunswick:* J. G. Lipman.[1]
NEW MEXICO—*State College:* Fabian Garcia.[1]
NEW YORK—
State Station: *Geneva;* U. P. Hedrick.[1]
Cornell Station: *Ithaca;* A. R. Mann.[1]
NORTH CAROLINA—*State College Station, Raleigh;* R. Y. Winters.[1]
NORTH DAKOTA—*State College Station, Fargo:* P. F. Trowbridge.[1]
OHIO—*Wooster:* C. G. Williams.[1]
OKLAHOMA—*Stillwater:* C. P. Blackwell.[1]
OREGON—*Corvallis:* J. T. Jardine.[1]
PENNSYLVANIA—
State College: R. L. Watts.[1]
State College: Institute of Animal Nutrition; E. B. Forbes.[1]
PORTO RICO—
Federal Station: *Mayaguez;* D. W. May.[1]
Insular Station: *Rio Piedras;* R. Fernández García.[1]
RHODE ISLAND—*Kingston:* B. E. Gilbert.[1]
SOUTH CAROLINA—*Clemson College:* H. W. Barre.[1]
SOUTH DAKOTA—*Brookings:* J. W. Wilson.[1]
TENNESSEE—*Knoxville:* C. A. Mooers.[1]
TEXAS—*College Station:* A. B. Conner.[1]
UTAH—*Logan:* P. V. Cardon.[1]
VERMONT—*Burlington:* J. L. Hills.[1]
VIRGINIA—
Blacksburg: A. W. Drinkard, Jr.[1]
Truck Station: *Norfolk;* T. C. Johnson.[1]
VIRGIN ISLANDS—*St. Croix:* J. B. Thompson.[1]
WASHINGTON—
College Station: *Pullman;* E. C. Johnson.[1]
Western Station: *Puyallup;* J. W. Kalkus.[3]
WEST VIRGINIA—*Morgantown:* F. D. Fromme.[1]
WISCONSIN—*Madison:* H. L. Russell.[1]
WYOMING—*Laramie:* J. A. Hill.[1]

[1] Director. [2] Acting Director. [3] Superintendent.

EXPERIMENT STATION RECORD

Editor: HOWARD LAWTON KNIGHT

EDITORIAL DEPARTMENTS

Agricultural and Biological Chemistry, Soils and Fertilizers—H. C. WATERMAN.
Meteorology—W. H. BEAL.
Agricultural Botany and Diseases of Plants—W. H. EVANS, W. E. BOYD
Genetics—H. M. STEECE, J. W. WELLINGTON, G. HAINES.
Field Crops—H. M. STEECE.
Horticulture and Forestry—J. W. WELLINGTON.
Economic Zoology and Entomology—W. A. HOOKER.
Animal Husbandry, Dairying, and Dairy Farming—H. W. MARSTON.
Veterinary Medicine—W. A. HOOKER.
Agricultural Engineering—R. W. TRULLINGER.
Rural Economics and Sociology, Agricultural and Home Economics Education—F. G. HARDEN.
Foods and Human Nutrition—SYBIL L. SMITH.
Textiles and Clothing—H. M. STEECE, SYBIL L. SMITH.
Home Management and Equipment— ——— ———.
Indexes—MARTHA C. GUNDLACH.
Bibliographies—CORA L. FELDKAMP.

CONTENTS OF VOLUME 61

EDITORIAL NOTES

	Page
Dr. Alfred Charles True, deceased (illustrated)	1
A trio of recent gatherings in Washington	101
Research and the Agricultural Marketing Act	301
Agricultural education in the United States, 1785–1925	401
The agricultural experiment stations in 1928	601
Edwin West Allen, 1864–1929 (illustrated)	701

STATION PUBLICATIONS ABSTRACTED

ALABAMA STATION:	
Bulletin 228	130
Circular 53	453
ALASKA STATIONS:	
Bulletin 8	158
ARIZONA STATION:	
Technical Bulletin 25	619
Technical Bulletin 26	618
Technical Bulletin 27	630
Timely Hints for Farmers No. 160	560

ARKANSAS STATION: Page
Bulletin 232 ---- 58
Bulletin 233 ---- 579
Bulletin 234 ---- 536
Bulletin 235 ---- 580
Bulletin 236 ---- 782
Bulletin 237 ---- 785
Bulletin 238 ---- 870
Bulletin 239 ---- 835
Bulletin 240 ---- 886
Bulletin 241 ---- 827
CALIFORNIA STATION:
Bulletin 465 ---- 242
Bulletin 466 ---- 282
Bulletin 467 ---- 437
Bulletin 468 ---- 467
Bulletin 469 ---- 779
Bulletin 470 ---- 737
Bulletin 471 ---- 739
Circular 314 ---- 356
Circulaar 315 ---- 659
Hilgardia—
Volume 3—
No. 17, January, 1929 ---- 90
No. 18, February, 1929 ---- 238
No. 19, February, 1929 ---- 260
No. 20, March, 1929 ---- 242
Volume 4—
No. 1, March, 1929 ---- 365
No. 2, April, 1929 ---- 420
No. 3, May, 1929 ---- 418
No. 4, May, 1929 ---- 620
No. 5, June, 1929 ---- 698
Annual Report, 1928 ---- 314, 317, 322, 326, 327, 334, 340, 341, 344, 346, 349, 350, 360, 361, 362, 364, 367, 369, 375, 378, 387, 393, 394
COLORADO STATION:
Bulletin 335 ---- 512
Bulletin 338 ---- 785
Bulletin 340 ---- 205
Bulletin 341 ---- 557
Bulletin 344 ---- 291
Bulletin 346 ---- 81
Bulletin 347 ---- 732
Bulletin 350 ---- 276
Press Bulletin 67 ---- 520
Press Bulletin 68 ---- 760
Forty-first Annual Report, 1928 ---- 115, 136, 151, 177, 197
CONNECTICUT STATE STATION:
Bulletin 299 ---- 134
Bulletin 300 ---- 355
Bulletin 301 ---- 859
Bulletin 302 ---- 349
Bulletin 303 ---- 558

CONNECTICUT STATE STATION—Continued. Page
Bulletin 304 ... 555
Bulletin 305 ... 547
Bulletin 306 ... 637
Bulletin 307 ... 890
CONNECTICUT STORRS STATION:
Bulletin 155 ... 430
Bulletin 156 ... 475
Thirty-eighth Annual Report, 1926 ... 197
Thirty-ninth Annual Report, 1927 ... 197
DELAWARE STATION:
Bulletin 160 ... 610
FLORIDA STATION:
Bulletin 202 ... 782
Bulletin 203 ... 754
Bulletin 204 ... 739
Bulletin 205 ... 837
Bulletin 206 ... 870
GEORGIA STATION:
Bulletin 150 ... 38
Bulletin 151 ... 118
Bulletin 152 ... 634
Bulletin 153 ... 685
Circular 84 ... 161
Circular 85 ... 778
Circular 86 ... 739
Forty-first Annual Report, 1928 ... 124, 136, 144, 158, 175, 179, 193, 197
GEORGIA COASTAL PLAIN STATION:
Bulletin 10 ... 136
HAWAII STATION:
Report, 1928 ... 723, 732, 790, 79
IDAHO STATION:
Bulletin 163 ... 766
Bulletin 164 (Annual Report, 1928) ... 810, 811, 822,
830, 837, 838, 847, 848, 857, 859, 861, 865, 869, 873, 874, 876, 896, 898
Circular 53 ... 808
Circular 54 ... 809
ILLINOIS STATION:
Bulletin 319 ... 37
Bulletin 320 ... 25
Bulletin 321 ... 460
Bulletin 322 ... 460
Bulletin 323 ... 460
Bulletin 324 ... 484
Bulletin 325 ... 460
Bulletin 326 ... 487
Bulletin 327 ... 425
Bulletin 328 ... 559
Bulletin 329 ... 684
Bulletin 330 ... 691
Bulletin 331 ... 886
Bulletin 332 ... 878
Bulletin 333 ... 869

ILLINOIS STATION—Continued. Page
Bulletin 334 ---- 836
Bulletin 335 ---- 828
Bulletin 336 ---- 834
Circular 334 ---- 357
Circular 335 ---- 190
Circular 336 ---- 179
Circular 337 ---- 179
Circular 338 ---- 252
Circular 339 ---- 489
Circular 340 ---- 483
Circular 341 ---- 563
Circular 342 ---- 714
Circular 343 ---- 738
Circular 344 ---- 772
Circular 345 ---- 763
Soil Report 42 ---- 17
Soil Report 43 ---- 809

INDIANA STATION:
Bulletin 324 ---- 207
Bulletin 325 ---- 259
Bulletin 326 ---- 234
Bulletin 327 ---- 441
Bulletin 328 ---- 690
Bulletin 329 ---- 623
Bulletin 330 ---- 664
Bulletin 331 ---- 663
Circular 153 ---- 265
Circular 158 ---- 229
Circular 159 ---- 261
Circular 160 ---- 220
Circular 161 ---- 732
Circular 162 ---- 210
Forty-first Annual Report, 1928 ---- 319, 328, 337, 342, 346, 352, 362, 363, 365, 368, 370, 376, 380, 386, 394

IOWA STATION:
Bulletin 255 (abridged edition) ---- 886
Bulletin 257 ---- 220
Bulletin 258 ---- 464
Bulletin 259 ---- 483
Bulletin 260 ---- 881
Bulletin 261 ---- 884
Research Bulletin 117 ---- 611
Research Bulletin 118 ---- 860
Circular 114 ---- 464
Circular 115 ---- 339
Circular 116 ---- 873
Current Economic Series Report 8 ---- 181
Leaflet 27 ---- 759
Soil Survey Report 54 ---- 421
Soil Survey Report 55 ---- 809
Annual Report, 1928 ---- 318, 329, 338, 340, 342, 344, 345, 353, 361, 362, 363, 364, 366, 368, 374, 375, 377, 381, 387, 391, 394.

KANSAS STATION: Page
Bulletin 246 — 186
Technical Bulletin 24 — 149
Circular 142 — 182
Circular 143 — 159
Circular 144 — 482
Circular 145 — 141
Circular 146 — 468
Circular 147 — 464
Biennial Report, 1927–1928 — 107, 114, 115, 116, 117, 121, 123, 125, 132, 137, 141, 144, 151, 156, 158, 160, 161, 162, 164, 166, 171, 172, 176, 178, 179, 190, 191, 193, 196, 197.

KENTUCKY STATION:
Bulletin 282 — 120
Bulletin 289 — 782
Circular 39 — 373
Circular 40 — 273
Fortieth Annual Report, 1927, Part 2 — 498

LOUISIANA STATIONS:
Bulletin 203 — 636

MAINE STATION:
Bulletin 347 — 183
Bulletin 348 — 540
Official Inspections 130 — 226, 228
Official Inspections 131 — 693

MARYLAND STATION:
Bulletin 300 — 821
Bulletin 301 — 383
Bulletin 302 — 447
Bulletin 303 — 224
Bulletin 304 — 582
Bulletin 305 — 583
Bulletin 306 — 641
Bulletin 307 — 642
Bulletin 308 — 655
Bulletin 309 — 622
Forty-first Annual Report, 1928 — 803, 823, 831, 887, 898

MASSACHUSETTS STATION:
Bulletin 247 (Biennial Report, 1927–1928) — 804, 810, 814, 823, 832, 839, 843, 844, 846, 848, 849, 866, 867, 889, 891, 898
Bulletin 248 — 448
Bulletin 249 — 454
Bulletin 250 — 690
Bulletin 251 — 784
Control Series Bulletin 44 — 59
Control Series Bulletin 45 — 20
Control Series Bulletin 46 — 322
Control Series Bulletin 47 — 334
Control Series Bulletin 48 — 677
Meteorological Series Bulletins 481–482, January–February, 1929 — 110
Meteorological Series Bulletins 483–484, March–April, 1929 — 314
Meteorological Series Bulletins 485–486, May–June, 1929 — 713

MICHIGAN STATION: Page
Special Bulletin 180 113
Special Bulletin 183 656
Special Bulletin 184 40
Special Bulletin 185 187
Special Bulletin 186 41
Special Bulletin 187 482
Special Bulletin 188 230
Special Bulletin 189 288
Special Bulletin 190 645
Special Bulletin 191 380
Technical Bulletin 96 286
Technical Bulletin 97 448
Technical Bulletin 98 and Chart Section 471
Technical Bulletin 99 525
Quarterly Bulletin—
Volume 11—
No. 3, February, 1929 33, 34, 37, 41, 42, 43, 46, 57, 65, 67, 73, 78
No. 4, May, 1929 442, 449, 454, 458, 462, 467, 471, 498
Volume 12—
No. 1, August, 1929 830, 838, 842, 851, 858, 867, 868, 873, 875
Circulars 108–116 18
Circulars 117–122 18
Circular 123 779
Circular 124 739
Circular 125 358
Circular 126 779
[Fortieth] Annual Report, 1927 411, 418, 420, 423, 432, 442, 443, 449, 459, 464, 468, 475, 498
[Biennial] Report, 1927–1928 708, 712, 714, 717, 718, 730, 731, 740, 746, 749, 763, 768, 772, 774, 787, 793, 797
MINNESOTA STATION:
Bulletin 245 85
Bulletin 246 85
Bulletin 247 88
Bulletin 248 60
Bulletin 249 585
Bulletin 250 774
Bulletin 251 786
Bulletin 252 331
Bulletin 253 787
Bulletin 254 789
Technical Bulletin 52 76
Technical Bulletin 53 39
Technical Bulletin 54 43
Technical Bulletin 55 382
Technical Bulletin 56 358
Technical Bulletin 57 740
Technical Bulletin 58 722
Thirty-sixth Annual Report, 1928 699
MISSISSIPPI STATION:
Bulletin 261 445
Bulletin 262 432, 438, 446, 498
Bulletin [263] [illegible]

MISSISSIPPI STATION—Continued. Page
Bulletin 264 ..... 433, 443, 498
Bulletin 265 442
Bulletin 266 ..... 433, 438, 446, 498
MISSOURI STATION:
Bulletin 264 810
Bulletin 265 836
Bulletin 266 860
Bulletin 267 887
Bulletin 268 879
Bulletin 269 883
Bulletin 270 815
Research Bulletin 119 40
Research Bulletin 120 169
Research Bulletin 121 141
MISSOURI FRUIT STATION:
Biennial Report, 1927–1928 797
MONTANA STATION:
Bulletin 216 153
Bulletin 217 422
Bulletin 218 483
Bulletin 219 488
Bulletin 220 684
Bulletin 221 690
NEBRASKA STATION:
Bulletin 229 160
Bulletin 230 196
Bulletin 231 182
Bulletin 232 129
Bulletin 233 178
Bulletin 234 882
Bulletin 235 879
Bulletin 236 879
Research Bulletin 43 768
Circular 37 175
Forty-second Annual Report, [1928] 811, 824, 833, 840, 857, 859, 860, 861, 866, 869, 877, 898
NEVADA STATION:
Bulletin 116 561
NEW HAMPSHIRE STATION:
Bulletin 236 59
Bulletin [237] 120
Bulletin 238 (Annual Report, 1928) 116, 126, 138, 142, 149, 150, 151, 153, 166, 171, 175, 176, 178, 180, 192, 197
Bulletin 239 885
Bulletin 240 857
Bulletin 241 885
Bulletin 242 890
Bulletin 243 854
Bulletin 244 897
Technical Bulletin 38 767
Circular 29 262

NEW JERSEY STATIONS: Page
Bulletin 455 — 661
Bulletin 468 — 451
Bulletin 469 — 452
Bulletin 470 — 655
Bulletin 474 — 480
Bulletin 480 — 451
Bulletin 481 — 21
Bulletin 482 — 211
Bulletin 483 — 521
Bulletin 484 — 437
Bulletin 486 — 780
Circular 216 — 255
Hints to Poultrymen, volume 17—
No. 2, November, 1928 — 62
No. 3, December, 1928 — 367
No. 4, January, 1929 — 367
No. 5, February, 1929 — 367
No. 6, March, 1929 — 367
No. 7, April, 1929 — 451
No. 8, May, 1929 — 573
No. 9, June, 1929 — 560
Report, 1928 — 710, 713, 714, 715, 718, 724, 733, 739, 741, 742, 747, 748, 749, 754, 758, 761, 763, 764, 767, 769, 781, 797.
NEW MEXICO STATION:
Bulletin 170 — 37
Bulletin 171 — 141
Bulletin 172 — 355
Bulletin 173 — 373
Bulletin 174 — 738
Bulletin 175 — 728
Thirty-ninth Annual Report, 1928 — 206, 219, 227, 236, 247, 258, 259, 261, 263, 267, 275, 283, 298
NEW YORK CORNELL STATION:
Bulletin 470 — 140
Bulletin 471 — 287
Bulletin 472 — 86
Bulletin 473 — 183
Bulletin 474 — 155
Bulletin 475 — 783
Bulletin 476 — 884
Bulletin 477 — 868
Memoir 118 — 184
Memoir 119 — 210
Memoir 120 — 132
Memoir 121 — 157
Memoir 122 — 426
Memoir 123 — 150
Memoir 124 — 748
NEW YORK STATE STATION:
Bulletin 562 — 833
Bulletin 563 — 340

NEW YORK STATE STATION—Continued. Page
Bulletin 564 446
Bulletin 565 441
Bulletin 566 562
Bulletin 567 562
Bulletin 568 562
Bulletin 569 524
Technical Bulletin 148 554
Technical Bulletin 149 513
Circular 106 155
Circular 107 155
Circular 108 154
Circular 109 155
Circular 110 141
Circular 111 155
Circular 112 644
Circular 113 662
The Vegetables of New York, Volume 1, Part 1: Peas, U. P. Hedrick, F. H. Hall, L. R. Hawthorn, and A. Berger 640

NORTH CAROLINA STATION:
Bulletin 263 34
Bulletin 264 175
Bulletin 265 447
Bulletin 266 622
Bulletin 267 686
Technical Bulletin 35 346
Technical Bulletin 36 770
Agronomy Information Circular 27 725
Agronomy Information Circular 28 726
Agronomy Information Circular 29 812
Fifty-first Annual Report, 1928 .... 713, 715, 718, 721, 725, 728, 734, 744, 752, 762, 764, 768, 770, 776, 797

NORTH DAKOTA STATION:
Bulletin 225 777
Bulletin 226 .... 726, 735, 797
Bulletin 227 .... 726, 735, 763, 797
Circular 37 729

OHIO STATION:
Bulletin 428 55
Bulletin 429 56
Bulletin 430 32
Bulletin 431 (Forty-seventh Annual Report, 1928) .... 416, 417, 430, 433, 439, 442, 444, 445, 449, 450, 456, 457, 458, 463, 465, 472, 473, 478, 481, 489, 492, 598.
Bulletin 432 446
Bulletin 433 585
Bulletin 434 527
Bulletin 435 685
Bulletin 436 663
Bulletin 437 667
Bimonthly Bulletin, Volume 14, No. 2 .... 130, 140, 150, 169, 170, 174, 179, 181
Bimonthly Bulletin 138 .... 423, 436, 437, 441, 454, 456, 457, 466, 482, 498

	Page
OHIO STATION—Continued.	
Bimonthly Bulletin 139	640, 645, 665, 683
Bimonthly Bulletin 140	835, 836, 842, 849, 858, 863, 882
Circular 1	96
Circular 2	96
Circular 3	62
Circular 5	96
Circular 6	62
Circular 7	34
Circular 8	59
Circular 11	32
Circular 12	66
Circular 13	66
Special Circular 14	79
OKLAHOMA STATION:	
Bulletin 178	484
[OKLAHOMA] PANHANDLE STATION:	
Panhandle Bulletin 2	38, 59, 67, 77
Panhandle Bulletin 3	32, 37, 66, 67, 96
Panhandle Bulletin 4	131, 166, 170, 177
Panhandle Bulletin 5	442, 447, 466, 487
Panhandle Bulletin 6	432, 441, 464, 498
Panhandle Bulletin 7	525, 530, 532, 559, 562
Panhandle Bulletin 8	825, 837, 873
OREGON STATION:	
Bulletin 237	20
Bulletin 238	74
Bulletin 239	232
Bulletin 240	422
Bulletin 241	582
Bulletin 242	541
Bulletin 243	540
Bulletin 244	689
Bulletin 245	685
Bulletin 246	633
Bulletin 247	643
Bulletin 248	685
Bulletin 249	692
Bulletin 250	684
Bulletin 251	784
Bulletin 252	738
Circular 88	79
Circular 89	32
Circular 90	423
Circular 91	442
Circular 92	779
Circular 93	768
Biennial Report, 1927–1928	18, 19, 20, 26, 35, 36, 43, 49, 50, 52, 59, 60, 65, 67, 68, 74, 89, 96
PENNSYLVANIA STATION:	
Bulletin 232	286
Bulletin 234	486

PENNSYLVANIA STATION—Continued. Page
Bulletin 235 572
Bulletin 236 740
Bulletin 237 776
Bulletin 238 776
Progress Report on the Use of Small Electric Motors for (1) Cutting Ensilage, (2) Sawing Wood, (3) Grinding Feed, H. B. Josephson and R. U. Blasingame 880

RHODE ISLAND STATION:
Bulletin 217 825
Bulletin 218 821
Annual Feed Circular, 1929 558
Forty-first Annual Report, [1928] 614, 635, 640, 676, 699

SOUTH CAROLINA STATION:
Bulletin 254 67
Bulletin 255 66
Bulletin 256 452
Bulletin 257 453
Bulletin 258 662
Bulletin 259 815
Circular 35 31
Circular 36 119

SOUTH DAKOTA STATION:
Bulletin 236 561
Bulletin 237 517
Bulletin 238 782
Annual Report, 1928 20, 25, 39, 46, 53, 61, 62, 66, 67, 75, 92, 96

TENNESSEE STATION:
Forty-first Annual Report, 1928 127, 140, 146, 197

TEXAS STATION:
Bulletin 392 158
Bulletin 393 536
Bulletin 394 556
Bulletin 395 581
Bulletin 396 521
Bulletin 397 633
Bulletin 398 729
Bulletin 399 826
Circular 53 238
Circular 54 298

UTAH STATION:
Bulletin 209 (Biennial Report, 1927–1928) 11, 18, 19, 20, 27, 37, 44, 47, 54, 58, 59, 63, 69, 75, 76, 87, 96
Bulletin 210 409
Bulletin 211 633
Bulletin 212 851
Bulletin 213 891
Circular 77 774
Circular 78 797
Circular 79 764

	Page
Vermont Station:	
Bulletin 285	83
Bulletin 286	64
Bulletin 287	21
Bulletin 288	84
Bulletin 289	48
Bulletin 290	59
Bulletin 291 (Forty-first Annual Report, 1928)	96
Bulletin 292	85
Bulletin 293	758
Virginia Station:	
Bulletin 265	677
Bulletin 266	885
Technical Bulletin 35	638
Technical Bulletin 36	347
Annual Report, 1920–1927	713, 716, 717, 726, 730, 735, 745, 752, 758, 768, 772, 788, 797
Virginia Truck Station:	
Bulletin 62	740
Bulletin 63	736
Bulletin 64	746
Bulletin 65	757
Bulletin 66	730
Washington College Station:	
Bulletin 230	141
Bulletin 231	379
Bulletin 232	550
Western Washington Station:	
Bulletin 11–W	29
Bulletin 12–W	572
West Virginia Station:	
Bulletin 211	233
Bulletin 213	162
Bulletin 214	231
Bulletin 216	136
Bulletin 217	517
Bulletin 220	165
Bulletin 220 (correction)	863
Bulletin 221	888
Circular 50	518
Circular 52	67
Circular 53	79
Circular 54	441
Wisconsin Station:	
Bulletin 404	368
Bulletin 405 (Annual Report, 1928)	107, 114, 115, 118, 119, 123, 127, 142, 147, 149, 150, 154, 160, 163, 164, 168, 170, 173, 181, 188, 191, 193, 194, 195, 197.
Bulletin 406	381
Bulletin 407	340
Bulletin 480	331
Research Bulletin 87	587

WISCONSIN STATION—Continued. Page
Research Bulletin 88 530
Research Bulletin 89 646
Research Bulletin 90 646

WYOMING STATION:
Bulletin 161 130
Bulletin 162 192
Bulletin 163 443
Bulletin 164 437
Bulletin 165 693
Bulletin 166 663

UNITED STATES DEPARTMENT OF AGRICULTURE PUBLICATIONS ABSTRACTED

Bulletin 1498, Distribution of the Classes and Varieties of Wheat in the United States, J. A. Clark, J. H. Martin, K. S. Quisenberry, J. R. Hooker, C. E. Leighty, and C. N. Dubois 638
Bulletin 1500, The Gluing of Wood, T. R. Truax 878
Technical Bulletin 77, The Host Plants of the European Corn Borer in New England, B. E. Hodgson 56
Technical Bulletin 87, White-Pine Blister Rust: A Comparison of European with North American Conditions, P. Spaulding 51
Technical Bulletin 88, Tobacco Cutworms, S. E. Crumb 853
Technical Bulletin 89, Biology of the European Red Mite in the Pacific Northwest, E. J. Newcomer and M. A. Yothers 157
Technical Bulletin 90, Life History of the Codling Moth in Northern Georgia, E. R. Van Leeuwen 453
Technical Bulletin 91, Leaf Temperatures of Cotton and Their Relation to Transpiration, Varietal Differences, and Yields, F. M. Eaton and G. O. Belden 30
Technical Bulletin 92, The Economic Aspects of Forest Destruction in Northern Michigan, W. N. Sparhawk and W. D. Brush 143
Technical Bulletin 93, Four Species of Range Plants Not Poisonous to Livestock, C. D. Marsh, A. B. Clawson, and G. C. Roe 70
Technical Bulletin 94, Soil Reconnaissance of the Panama Canal Zone and Contiguous Territory, H. H. Bennett 113
Technical Bulletin 95, The Meal Worms, R. T. Cotton and R. A. St. George 453
Technical Bulletin 97, Relation of Kernel Density to Table and Canning Quality in Different Varieties of Maize, C. W. Culpepper and C. A. Magoon 38
Technical Bulletin 98, Imported Parasites of the European Corn Borer in America, D. W. Jones 57
Technical Bulletin 99, A Monographic Study of Sweet-Potato Diseases and Their Control, L. L. Harter and J. L. Weimer 447
Technical Bulletin 100, Respiration of Sorghum Grains, D. A. Coleman, B. E. Rothgeb, and H. C. Fellows 33
Technical Bulletin 102, Types of Farming in North Dakota, F. F. Elliott, J. W. Tapp, and R. E. Willard 181
Technical Bulletin 103, The Persistence of Differentiation among Inbred Families of Guinea Pigs, S. Wright and O. N. Eaton 218
Technical Bulletin 104, Deterioration of Wind-Thrown Timber on the Olympic Peninsula, Wash., J. S. Boyce 143

Page

Technical Bulletin 105, A Short Method of Calculating Energy, Protein, Calcium, Phosphorous, and Iron in the Diet, E. Hawley 191
Technical Bulletin 106, Extension Methods and Their Relative Effectiveness, M. C. Wilson 188
Technical Bulletin 107, Wholesale Marketing of Live Poultry in New York City, F. A. Buechel 485
Technical Bulletin 108, Stiffness in Fabrics Produced by Different Starches and Starch Mixtures, and a Quantitative Method for Evaluating Stiffness, E. C. Peterson and T. Dantzig 497
Technical Bulletin 110, Correcting the Inefficiency of Peanuts for Growth in Pigs, O. G. Hankins and J. H. Zeller 462
Technical Bulletin 111, Fish Oil as an Adhesive in Lead-Arsenate Sprays, C. E. Hood 356
Technical Bulletin 115, Factors Affecting the Price of Peaches in the New York City Market, H. S. Kantor 486
Technical Bulletin 116, Dairy Work at the Huntley Field Station, Huntley, Mont., 1918–1927, T. W. Moseley, D. Stuart, and R. R. Graves 669
Technical Bulletin 117, Comparative Influence of Different Storage Temperatures on Weight Losses and Vitality of Seed Potatoes, W. Stuart, P. M. Lombard, and W. M. Peacock 635
Technical Bulletin 120, Relation of Husk Covering to Smut of Corn Ears, C. H. Kyle 745
Technical Bulletin 124, Some Factors Affecting the Marketing of Wool in Australia, New Zealand, the Union of South Africa, England, and France, J. F. Walker 786
Technical Bulletin 125, Relative Costs of Extension Methods Which Influence Changes in Farm and Home Practices, H. J. Baker and M. C. Wilson 789
Farmers' Bulletin 744 (rev.), The Preservative Treatment of Farm Timbers, G. M. Hunt 679
Farmers' Bulletin 1326 (rev.), Control of the Codling Moth in the Pacific Northwest, E. J. Newcomer, M. A. Yothers, and W. D. Whitcomb 660
Farmers' Bulletin 1539, High-Grade Alfalfa Hay: Methods of Producing, Baling, and Loading for Market, E. C. Parker 129
Farmers' Bulletin 1555, Peppermint and Spearmint as Farm Crops, A. F. Sievers 140
Farmers' Bulletin 1567, Propagation of Trees and Shrubs, G. E. Yerkes 441
Farmers' Bulletin 1572, Making Cellars Dry, G. M. Warren 882
Farmers' Bulletin 1578, Marketing Late-Crop Potatoes, W. A. Sherman, G. B. Fiske, and J. W. Park 187
Farmers' Bulletin 1579, Containers Used in Shipping Fruits and Vegetables, H. A. Spilman and R. W. Davis 339
Farmers' Bulletin 1581, Oats in the North-Central States, T. R. Stanton and F. A. Coffman 728
Farmers' Bulletin 1584, Feed-Lot and Ranch Equipment for Beef Cattle, W. H. Black and V. V. Parr 779
Farmers' Bulletin 1586, the Southern Pine Beetle: A Serious Enemy of Pines in the South, R. A. St. George and J. A. Beal 757
Farmers' Bulletin 1587, Mushroom Culture for Amateurs, V. K. Charles 140
Farmers' Bulletin 1588, Frost and the Prevention of Frost Damage, F. D. Young 228
Farmers' Bulletin 1589, The Husker-Shredder on Eastern Corn Belt Farms, G. W. Collier, W. R. Humphries, and E. W. McComas 78

Page

Farmers' Bulletin 1590, Fire-Protective Construction on the Farm...... 282
Farmers' Bulletin 1592, Beef Production on the Farm, W. H. Black and E. W. McComas...... 759
Farmers' Bulletin 1594, Preparation of Bunched Beets, Carrots, and Turnips for Market, W. E. Lewis...... 834
Farmers' Bulletin 1595, The Bollworm or Corn Ear Worm as a Cotton Pest, F. C. Bishopp...... 756
Farmers' Bulletin 1596, Cattle Grubs or Heel Flies with Suggestions for Their Control, F. C. Bishopp, E. W. Laake, and R. W. Wells...... 757
Farmers' Bulletin 1600, Dehorning, Castrating, Branding, and Marking Beef Cattle, W. H. Black and V. V. Parr...... 759
Statistical Bulletin 25, Dairy Statistics: Year Ended December 31, 1926, with Comparable Data for Earlier Years...... 384
Statistical Bulletin 26, Cold-Storage Holdings...... 85
Circular 43, Home Demonstration Work under the Smith-Lever Act, 1914–1924, F. E. Ward...... 789
Circular 49, Culture and Outdoor Winter Storage of Persimmons in the Vicinity of Peking, China, P. H. and J. H. Dorsett...... 41
Circular 50, Proximate Composition of Fresh Fruits, C. Chatfield and L. I. McLaughlin...... 89
Circular 51, The Chinch Bug in Relation to St. Augustine Grass, R. N. Wilson...... 356
Circular 52, Varietal Standardization of Sorgo and the Selection of Seed, H. B. Cowgill...... 729
Circular 53, A Seed Counter, E. Brown, E. H. Toole, and W. L. Goss...... 34
Circular 54, Developments and Problems in Farmers' Mutual Fire Insurance, V. N. Valgren...... 82
Circular 55, Soil Factors Influencing Crop Production in the Arkansas Valley, Colorado, A. T. Sweet...... 19
Circular 56, Methods for Determining the Hydrogen-ion Concentration of Soils, E. F. Snyder...... 12
Circular 57, The Rural Church and Cooperative Extension Work, H. W. Hochbaum...... 87
Circular 58, Planning and Conducting Extension Campaigns, H. W. Hochbaum...... 87
Circular 59, Removal of Spray Residue from Apples and Pears in the Pacific Northwest, H. C. Diehl, D. F. Fisher, H. Hartman, J. R. Magness, and R. H. Robinson...... 40
Circular 60, The Farm Real Estate Situation, 1927–28, E. H. Wiecking...... 79
Circular 61, A High-Pressure Gas-Compression System, J. R. Dilley and W. L. Edwards...... 78
Circular 62, The Utilization of Browse Forage as Summer Range for Cattle in Southwestern Utah, C. L. Forsling and E. V. Storm...... 558
Circular 64, Cyanamid, Its Uses as a Fertilizer Material, F. E. Allison...... 815
Circular 65, Steer-Feeding Experiments in the Sugar-Cane Belt, J. R. Quesenberry...... 457
Circular 67, A Prolonged Saprophytic Stage of the Cotton Root-Rot Fungus, G. T. Ratliffe...... 446
Circular 68, Azaleas and Rhododendrons from Seed, B. Y. Morrison...... 739
Circular 70, Work of the Huntley Field Station, Montana, in 1925 and 1926, D. Hansen, A. E. Seamans, and D. A. Savage...... 724, 733, 760, 761, 797

	Page
Circular 71, Heat and Time of Exposure Necessary to Kill Larvae of the European Corn Borer in Ear Corn, G. W. Barber	852
Circular 72, Financial Settlements of Defaulting Irrigation Enterprises, W. A. Hutchins	785
Circular 73, The Cold Storage of Eggs and Poultry, T. W. Heitz	787
Circular 74, Chemical Injury to Watermelons in Transit, W. W. Gilbert and F. C. Meier	746
Circular 75, The True Cricket—a Serious Cotton Pest in California, E. A. McGregor	754
Circular 76, Fires in Cotton Gins and How to Prevent Them, H. E. Roethe	479
Circular 77, Suggestions for Paper-Mulch Trials, L. H. Flint	440
Miscellaneous Circular 110, Ramie, a Fiber-Yielding Plant, L. H. Dewey	729
Leaflet 30, Cutting the Farm Woods "Profitwise," R. D. Garver	144
Leaflet 32, Planting Southern Pine, P. C. Wakeley	532
Leaflet 33, The Combination Cleaning and Treating of Seed Wheat, F. C. Meier, E. G. Boerner, G. P. Bodnar, C. E. Leighty, and J. E. Coke	132
Leaflet 34, Trichinosis, a Disease Caused by Eating Raw Pork, B. Schwartz	471
Leaflet 35, Producing Pine Nursery Stock in the South, P. C. Wakeley	341
Leaflet 36, Gourds for Bird Houses and Other Purposes, W. L. McAtee and J. H. Beattie	449
Leaflet 37, Poisoning the Cotton Boll Weevil, B. R. Coad and R. C. Gaines	360
Leaflet 38, Maintaining the Health of Livestock in Transit, A. W. Miller	570
Leaflet 39, Eggs at Any Meal, L. M. Alexander and F. W. Yeatman	291
Leaflet 40, Woods Burning in the South	341
Leaflet 41, Good Naval-Stores Practice, A. Cary	443
Leaflet 42, Good Food Habits for Children, C. R. Schmidt	490
Miscellaneous Publication 14, Pooling as Practiced by Cooperative Marketing Associations, C. L. Christensen	384
Miscellaneous Publication 33, Advantages of Standards for Livestock and Meats, C. E. Gibbons	157
Miscellaneous Publication 34, United States Animal Husbandry Experiment Farm, Beltsville, Md., E. W. Sheets and B. F. Brandon	457
Miscellaneous Publication 35, Cotton or Weevils, J. L. Webb and F. A. Merrill	156
Miscellaneous Publication 36, A History of Agricultural Education in the United States, 1785–1925, A. C. True	489
Miscellaneous Publication 37, Essentials for the Successful Operation of a Local Creamery, W. White	67
Miscellaneous Publication 38, Research in Mechanical Farm Equipment, H. B. Walker	78
Miscellaneous Publication 39, Rio Grande National Forest, Colorado	42
Miscellaneous Publication 40, Forest Fire Prevention Handbook for the Schools of Washington	86
Miscellaneous Publication 41, Pulp-Timber Resources of Southeastern Alaska, B. F. Heintzleman	42
Miscellaneous Publication 42, Points to Consider in Establishing a Cheese Factory, H. L. Wilson	67
Miscellaneous Publication 43, Workers in Subjects Pertaining to Agriculture in State Agricultural Colleges and Experiment Stations, 1928–1929, M. A. Agnew	290
Miscellaneous Publication 44, The Agricultural Outlook for 1929	82

Page

Miscellaneous Publication 45, Forestry Clubs for Young People, M. F. Heisley ---- 385
Miscellaneous Publication 46, The Strength of North American Woods, H. S. Betts ---- 775
Miscellaneous Publication 47, Directory of Field Activities of the Plant Quarantine and Control Administration ---- 740
Miscellaneous Publication 48, The Food, Drug, and Insecticide Administration ---- 712
Miscellaneous Publication 49, Directory of Field Activities of the Bureau of Biological Survey ---- 748
Agriculture in the United States ---- 487
Inventory 87, Plant Material Introduced by the Office of Foreign Plant Introduction, Bureau of Plant Industry, April 1 to June 30, 1926 ---- 24
Inventory 88, Plant Material Introduced by the Office of Foreign Plant Introduction, Bureau of Plant Industry, July 1 to September 30, 1926 ---- 325
Yearbook 1928 ---- 487, 498
Crops and Markets:
Volume 6—
No. 2, February, 1929 ---- 85
No. 3, March, 1929 ---- 188
No. 4, April, 1929 ---- 384
No. 5, May, 1929 ---- 487
No. 6, June, 1929 ---- 584
No. 7, July, 1929 ---- 787
No. 8, August, 1929 ---- 887
Official Record, Volume 8, No. 32, August 8, 1929 ---- 688

EXTENSION SERVICE:
An Analysis of the Managerial Responsibilities of the Farm Home Maker, C. H. Schopmeyer ---- 298
Cooperative Extension Work, 1926, C. B. Smith et al ---- 189

LIBRARY:
Agricultural Library Notes, Volume 4, No. 1–2, Supplement, 1929 ---- 520

OFFICE OF EXPERIMENT STATIONS:
Report on the Agricultural Experiment Stations, 1927, E. W. Allen, W. H. Beal, J. I. Schulte, et al ---- 31, 77, 96
Report on the Agricultural Experiment Stations, 1928, E. W. Allen, W. H. Beal, H. M. Steece, et al ---- 699

BUREAU OF AGRICULTURAL ECONOMICS:
Agricultural Economics Bibliography—
No. 26, Labor Requirements of Farm Products in the United States: A list of References to Material Published since 1922, compiled by L. O. Bercaw ---- 482
No. 27, Agricultural Relief: A Selected and Annotated Bibliography, compiled by E. M. Colvin ---- 688
Atlas of American Agriculture: Part II, Climate.—Section B, Temperature, Sunshine, and Wind, J. B. Kincer ---- 313
Charts Relating to the 1929 Agricultural Outlook.—Part I, Farm Crops ---- 584
Charts Relating to the 1929 Agricultural Outlook.—Part II, Livestock and Products ---- 584
Poultry and Egg Outlook Charts, with Explanations ---- 887

Bureau of Agricultural Economics—Continued. Page
Ranch Organization and Operation in the Northern Great Plains Region, 1927 ... 581
The Perquisites and Wages of Hired Farm Hands, J. C. Folsom ... 786

Bureau of Biological Survey:
Alaska Game Commission Circular 6, Laws and Regulations Relating to Game Land Fur-Bearing Animals and Birds in Alaska, 1929–30 ... 542

Bureau of Chemistry and Soils:
Review of United States Patents Relating to Pest Control, volume 1—
No. 1, January, 1928 ... 543
No. 2, February, 1928 ... 543
No. 3, March, 1928 ... 543
No. 4, April, 1928 ... 543
No. 5, May, 1928 ... 543
No. 6, June, 1928 ... 543
No. 7, July, 1928 ... 543
No. 8, August, 1928 ... 543
No. 9, September, 1928 ... 543
No. 10, October, 1928 ... 543
No. 11, November, 1928 ... 543
No. 12, December, 1928 ... 543
Field Operations, 1923, Soil Survey of Olmstead County, Minnesota, J. A. Elwell et al ... 111
[Soil Survey Reports], Series 1923—
No. 1, Soil Survey of Clarke County, Iowa, A. M. O'Neal and C. B. Boatwright ... 206
No. 2, Soil Survey of Camden and Currituck Counties, North Carolina, S. O. Perkins et al ... 206
No. 3, Soil Survey of Sampson County, North Carolina, R. C. Jurney et al ... 206
No. 4, Soil Survey of Jenkins County, Georgia, E. D. Fowler and J. M. Snyder ... 615
No. 5, Soil Survey of Rockwall County, Texas, H. V. Geib ... 615
No. 6, Soil Survey of Maury County, Tennessee, J. H. Agee and J. A. Kerr ... 615
No. 7, Soil Survey of Fannin County, Georgia, S. W. Phillips and J. W. Stephenson ... 809
No. 8, Soil Survey of Las Vegas Area, Nevada, E. J. Carpenter and F. O. Youngs ... 615
No. 9, Soil Survey of Mercer County, West Virginia, A. W. Goke ... 206
No. 10, Soil Survey of Dooly County, Georgia, S. W. Phillips et al ... 615
No. 11, Soil Survey of Dickson County, Tennessee, J. A. Kerr et al ... 206
No. 13, Soil Survey of Greene County, Alabama, J. F. Stroud et al ... 421
No. 14, Soil Survey of Lake County, Florida, A. E. Taylor et al ... 206
No. 15, Soil Survey of Kearney County, Nebraska, M. H. Layton et al ... 206
No. 16, Soil Survey of the Coachella Valley Area, California, A. E. Kocher and W. G. Harper ... 206
No. 25, Soil Survey of Plymouth County, Iowa, D. S. and A. L. Gray ... 206
No. 29, Soil Survey of Antrim County, Michigan, J. O. Veatch et al ... [illegible]

BUREAU OF CHEMISTRY AND SOILS—Continued.
[Soil Survey Reports], Series 1923—Continued. Page
No. 31, Soil Survey of Macomb County, Michigan, R. Wildermuth et al 14
No. 32, Soil Survey of Lycoming County, Pennsylvania, E. H. Stevens et al 111
No. 33, Soil Survey of Walworth County, South Dakota, J. A. Machlis and G. A. Larson 14
No. 34, Soil Survey of Lawrence County, Missouri, A. T. Sweet and H. V. Jordan 14
No. 35, Soil Survey of St. Marys County, Maryland, S. O. Perkins 111
No. 36, Soil Survey of Isabella County, Michigan, J. A. Kerr and F. W. Trull 14
No. 37, Soil Survey of Livingston County, Michigan, L. C. Wheeting and S. G. Bergquist 421
No. 38, Soil Survey of Henderson County, Texas, H. W. Hawker and R. E. Devereux 111
No. 39, Soil Survey of Berkshire County, Massachusetts, W. J. Latimer and M. O. Lanphear 421
No. 40, Soil Survey of Monroe County, Wisconsin, W. J. Geib et al 615
No. 41, Soil Survey of Adams County, Nebraska, F. A. Hayes and D. F. Hyde 615
No. 42, Soil Survey of Platte County, Nebraska, L. S. Paine et al 615
No. 43, Soil Survey of Pierce County, Wisconsin, W. J. Geib et al 615
[Soil Survey Reports], Series 1924—
No. 3, Soil Survey of the Bishop Area, California, E. B. Watson and R. E. Storie 15
No. 4, Soil Survey of Chattahoochee County, Georgia, E. W. Knobel et al 112
No. 6, Soil Survey of Greene County, North Carolina, S. O. Perkins and H. G. Lewis 15
No. 7, Soil Survey of Harrison County, Mississippi, R. Wildermuth et al 15
No. 8, Soil Survey of Fremont County, Iowa, C. L. Orrben and L. S. Paine 15
No. 9, Soil Survey of Jones County, Iowa, A. M. O'Neal and R. E. Devereux 15
No. 10, Soil Survey of Hillsdale County, Michigan, J. O. Veatch et al 15
No. 11, Soil Survey of Worcester County, Maryland, S. O. Perkins and S. R. Bacon 15
No. 12, Soil Survey of Buffalo County, Nebraska, F. A. Hayes et al 15
No. 13, Soil Survey of Cherokee County, Iowa, D. S. Gray and B. H. Hendrickson 15
No. 14, Soil Survey of Barry County, Michigan, E. B. Deeter and F. W. Trull 15
No. 15, Soil Survey of the Auburn Area, California, S. W. Cosby et al 112
No. 16, Soil Survey of Randolph County, Georgia, S. W. Phillips et al 15
No. 17, Soil Survey of Garden County, Nebraska, L. A. Wolfanger et al 422

BUREAU OF CHEMISTRY AND SOILS—Continued.

[Soil Survey Reports], Series 1924—Continued. Page

No. 18, Soil Survey of Sheboygan County, Wisconsin, W. J. Geib et al ---- 315

No. 19, Soil Survey of Wichita County, Texas, W. T. Carter et al ---- 617

No. 20, Soil Survey of Butler County, Nebraska, A. W. Goke and G. E. Bates ---- 617

No. 21, Soil Survey of Summers County, West Virginia, J. A. Kerr ---- 617

No. 22, Soil Survey of Muskegon County, Michigan, L. C. Wheeting and A. E. Matthews ---- 317

[Soil Survey Reports], Series 1925—

No. 1, Soil Survey of Lamar County, Georgia, S. O. Perkins et al ---- 17

No. 2, Soil Survey of Calhoun County, Georgia, J. W. Moon and H. G. Lewis ---- 17

No. 3, Soil Survey of Lake County, Ohio, A. E. Taylor ---- 314

BUREAU OF ENTOMOLOGY:

Report of Conference on Research Investigations of the European Corn Borer, Washington, D. C., January 6 and 7, 1927 ---- 552

Complete Research Program, European Corn Borer, 1928 ---- 553

Complete Research Program, European Corn Borer, 1929 ---- 553

Report of the Third Annual Conference on European Corn Borer Research, Washington, D. C., January 2, 1929 ---- 553

BUREAU OF PUBLIC ROADS:

Public Roads—

Volume 9—

No. 12, February, 1929 ---- 78

Volume 10—

No. 1, March, 1929 ---- 177

No. 2, April, 1929 ---- 379

No. 3, May, 1929 ---- 477

No. 4, June, 1929 ---- 775

No. 5, July, 1929 ---- 775

No. 6, August, 1929 ---- 878

Report of a Survey of Transportation on the State Highways of Pennsylvania ---- 177

WEATHER BUREAU:

Monthly Weather Review—

Volume 56—

No. 11, November, 1928 ---- 111

No. 12, December, 1928 ---- 110

Volume 57—

No. 1, January, 1929 ---- 313

No. 2, February, 1929 ---- 313

No. 3, March, 1929 ---- 613

No. 4, April, 1929 ---- 613

Climatological Data—

Volume 15—

Nos. 11–12, November–December, 1928 ---- 110

Volume 16—

Nos. 1–2, January–February, 1929 ---- 416

Nos. 3–4, March–April, 1929 ---- 713

Report, 1928 ---- 110

ALFRED CHARLES TRUE, 1853–1929

EXPERIMENT STATION RECORD

Vol. 61 | July, 1929 | No. 1

Dr. Alfred Charles True, specialist in states relations work in the U. S. Department of Agriculture, died in Washington, D. C., on April 23, 1929. Although he was in his seventy-sixth year, he had continued in active service until shortly before his death, and his recovery from a major surgical operation had seemed not improbable. Funeral services were held on April 25 at the Foundry Methodist Episcopal Church, of which he was a trustee and chairman of its committee on education, and burial was in Flushing, N. Y.

So passed away one of the most eminent authorities and widely influential leaders the cause of agricultural education has ever known. For over 40 years Dr. True had been associated with the Federal Department of Agriculture, and during most of this long period he had largely directed its relationships with the two great cooperative systems of agricultural research and agricultural extension. In addition, he had contributed materially to the advancement of resident instruction in the land-grant colleges and to the development and improvement of agricultural and home economics teaching in the secondary and common schools of the Nation.

Dr. True came to be so generally recognized as one of the best informed men of his generation in matters pertaining to agricultural education and research that his lack of specific academic training in agriculture seems surprising. He was born in Middletown, Conn., on June 5, 1853, nine years before the passage of the first Morrill Act. He was the son of a Methodist minister who was serving as a professor at Wesleyan University, and after living in various places prepared for college at the Boston Latin School. In Wesleyan University his education was along classical lines, and on graduation in 1873 he spent the next 15 years in general educational work, first as a high school principal at Essex, N. Y., then as a teacher in the State Normal School at Westfield, Mass., a graduate student at Harvard University, and an instructor in Wesleyan University. From Wesleyan he received the degree of master of arts in 1876 and that of doctor of science in 1906, while the honorary degree of doctor of philosophy was conferred by Erskine College in 1886.

Entering the service of the Federal Department of Agriculture as editor in the Office of Experiment Stations in 1889, he thus came into the work with a sound scholastic training, a considerable and varied teaching experience, mature years, and a broad and unprejudiced viewpoint. His selection as the third member of the new Office of Experiment Stations, then consisting of Drs. W. O. Atwater and A. W. Harris, was soon recognized as fortunate, and is an illuminating instance of the almost uncanny ability of Dr. Atwater to discover and inspire outstanding men.

Among the first duties of the new editor was the preparation of an article descriptive of the experiment station movement in the United States, which appeared as a part of Bulletin 1 of the Office in 1889. Data were also collected for a history of agricultural education and research in this country for distribution in connection with the United States Government exhibit at the Paris Exposition in 1889. To this work he applied himself with characteristic thoroughness and acumen, and in consequence he soon familiarized himself with the status of the movement as it had thus far been developed. This experience was both broadening and enlightening, for it enabled him to begin early to think of agricultural education and research on a national basis and to visualize the future of the colleges and stations as permanent agencies working for the promotion of the welfare of the country as a whole.

In 1891 Dr. True was appointed assistant director of the Office of Experiment Stations and in 1893 he became director, but for some time he continued to be occupied mainly with the preparation of publications and similar matters. This was well-nigh inevitable, for the principal function open to the Office at the time was as a clearing house of information. Its publications were its major activity, and covered a wide range of subject matter. Among them were the popular compilations of station material issued for many years, numerous articles on the progress of agricultural education and research here and abroad, monographs on specific topics, and the card index of experiment station literature. Dr. True was then, as throughout his life, much interested in questions of terminology, a field for which his scholastic training gave him unusual qualifications. He was likewise a believer in the need of disseminating accurate and adequate information on agricultural matters through general works of reference, and participated at various times in and actively encouraged such enterprises as the revision of dictionaries and encyclopedias from this general point of view.

While not the first editor of *Experiment Station Record*, he was one of its original staff, its titular head from 1893 to 1899, and the author of many of its policies and practices. Upon the change in

the arrangement of abstracts from a geographical to a topical basis in 1892, he was for some months in charge of the sections of botany, field crops, and horticulture. He was personally largely responsible for the system of classification of material then adopted, a system which proved so comprehensive and adaptable that it has endured without material modification to the present time.

Although the Office of Experiment Stations was established in 1888 to represent the Secretary of Agriculture in his relations with the stations under the Hatch Act, it was not until several years later that authority was given to do more than " indicate from time to time such lines of inquiry as to him shall seem most important and in general to furnish such advice and assistance as will best promote the purposes of this act." The inclusion in the appropriation act for the Department for 1894 of a clause directing the Secretary to ascertain whether the expenditures made under the act were in accordance with its provisions and to report thereon to Congress therefore enlarged the duties of the Office materially and increased its responsibilities. As a result, its work was greatly expanded and reorganized. A scheme for classifying and reporting the expenditures was prescribed, and an interpretation was made of the act and of the purpose to which the funds might be applied. Led by Dr. True, a systematic visitation of the stations was begun in addition to these supervisory functions. The Office was thus brought into more intimate contacts and closer relationships with the stations, and its influence became more direct and positive.

This transition from what a station director had termed " the manufacture of publications " to the duty of " visiting, advising, and criticizing " was not a matter to be lightly undertaken. While the propriety and desirability of accounting for the Federal funds was generally conceded, the stations had been developing with little supervision, and in a few cases their governing authorities were inclined to look with some suspicion upon what they thought might encroach upon their independence and bring about even a semblance of centralized control. That this feeling did not develop to more serious proportions was perhaps due more largely to Dr. True's own attitude and personality than to any other factor.

This attitude was well indicated in his initial report when he said frankly and definitely: " While we deplore the mistakes which have grown out of the too sudden expansion of the experiment station movement and the misconceptions regarding their functions existing in many quarters, we nevertheless would not change the general system established by the Hatch Act. The principle of local control with a view to meeting the varied needs of different agricultural

regions is in harmony with our governmental and educational system, and in the long run will undoubtedly produce the best results. The responsibility resting upon the State and Territorial authorities to maintain these stations will lead to their development in proportion to the interest taken in them by the people, and when once this interest is sufficiently awakened it will conduce to the building up of strong stations."

Perhaps equally helpful to cordial relations was his desire to become thoroughly familiar with the station work and problems. On this point he said: "Personal acquaintance with the men in charge of the stations and with their environment will undoubtedly contribute in various ways to a more complete and just knowledge of the real merits of the work undertaken by the stations and of the hindrances to the complete success of their enterprises. It is believed that in no way can this Department more effectually carry out that provision of the Hatch Act which enjoins upon it the duty of furnishing 'such advice and assistance as will best promote the purpose of this act' than by cultivating close personal relations with station officers and seeking to obtain an intimate knowledge of the conditions under which their work is performed."

Thus there came about in the years which followed what has been termed by the Institute for Government Research "a unique example of national administration," in which "influence rather than coercion is the policy." In establishing this policy the keystone was the confidence which everywhere was felt in Dr. True's breadth of view and liberality, his recognition of the stations as fundamentally State institutions, and his sound and unbiased judgment. Progress on this basis through the uncharted shoals of Federal and State relationships sometimes seemed slow to the impatient, but as the voyage proceeded, with skillful avoidance of reefs and steady progress, the conviction deepened that a master hand was at the wheel. Also it was discovered that Dr. True was a counselor of rare insight and wisdom. Seldom did he resort to such authority as was vested in his office, although he could be firm upon occasion. As he once expressed the matter, "Words of friendly criticism may be as silver, but far better are golden words of encouragement." His method was customarily to suggest the better way, and in due season it was usually given a trial and found to be good. So without ostentation or blare of trumpets, without fret or friction, his influence and that of the Office steadily grew and widened.

The passage of the Adams Act in 1906, providing added funds for the experiment stations and notably for fundamental investigation, enlarged the duties of the Office and called for an intelligent and enlightened interpretation of original research as distinguished from

other experimental activities. It marked the beginning of the project system as applied to the Federal funds, the projects for this fund being submitted for approval in advance in order to avoid misunderstanding later regarding the applicability of the fund to them. At the outset this requirement gave rise to numerous questions and renewed apprehension of a type of supervision which might handicap the stations. This again was allayed by the course pursued and came to be regarded instead as a stimulus and support for thoroughgoing research of a high order.

One of the great agencies in bringing about close contacts with the colleges and stations and developing their work has been the Association of American Agricultural Colleges and Experiment Stations, now the Association of Land-Grant Colleges and Universities. Dr. True's relations with this body were of long standing and in the aggregate of much importance. From what seems to have been his first appearance before the group in 1892, when he gave a talk before the section on botany on the laboratory exhibit of botany and horticulture at the Columbian Exposition, he was continuously on its program and active in its committees and work. He edited its proceedings from 1893 to 1897, and with other assistance thereafter until 1910. He was chosen bibliographer in 1895 and redesignated in each succeeding year, his 31 reports containing a wealth of useful information, much of which would otherwise have remained unavailable. In 1896 he brought in the first report of the committee on methods of teaching agriculture, and thenceforth he served without interruption as chairman of that committee and its successors, presenting during this period an enormous amount of data of great pedagogic interest. He also served for shorter periods on other committees for the consideration of nomenclature, the indexing of agricultural literature, and the collective station exhibit at the Paris Exposition in 1900.

In 1913 he was honored by the association by election to its presidency, and the following year delivered an address dealing particularly with the extension movement and notable for its prescience and broad vision. At a time when many men were perturbed lest the rapid expansion and wide popular appeal of the new extension enterprise might break down "the thoroughness of investigation and the solidity of teaching," he predicted confidently that in a short time the progress of the extension work would be found to be limited by the supply of reliable information and the number of well-trained men and women, so that in the end both research and resident instruction would be greatly strengthened. In all such matters he could be relied upon to discover and reveal the long-time view, and his ability thus to look beyond the perplexities of the present doubtless ac-

counted in part for his serene faith even in times of ill health and uncertainty.

Still another valuable service for the association was as dean of its five successive graduate schools of agriculture, distributed from 1902 to 1916. The graduate school was an enterprise in which he was greatly interested as an agency for providing advanced training for college and station workers and other leaders in the days when there was comparatively little opportunity for post-graduate instruction in agriculture through other channels. In this and other respects the school served a very useful purpose, and the stimulation and inspiration which it brought were in no small degree due to the consistent organization of the work on a high plane of scholarship, with opportunity for contact with leaders, which it received at the hands of its dean.

As the years went by the field covered by the Office of Experiment Stations increased in complexity. To its original task of representing the Department in its relations with the experiment stations were added from time to time such diverse functions as the carrying on of work in human nutrition, investigations in irrigation and drainage, and the gathering of information and rendering of other assistance as regards agricultural schools and farmers' institutes. In addition to this constantly growing burden of supervision, Dr. True was also entrusted with various special duties, such as service on the building committee of the Department when its laboratory wings were under construction and his designation as the representative of the United States in the General Assembly of the International Institute of Agriculture at Rome in 1913.

The passage of the Smith-Lever Act in 1914 brought under Dr. True's leadership a much larger undertaking than ever before, the direction of the States Relations Service, established on July 1, 1915, to include in addition to the former duties of the Office of Experiment Stations, the cooperative demonstration and similar extension work previously carried on by other branches of the Department, and the administration of the Smith-Lever Act itself. Here was a mission not only of great magnitude but of peculiar difficulty and delicacy. As was recently pointed out in these columns, work of the kinds contemplated by the Smith-Lever Act was then being conducted by the Department, State departments of agriculture, the State agricultural colleges, and county farm bureaus or similar organizations. The State and local organizations varied widely as regards the laws, regulations, and relationships pertaining to their work, and their funds were derived from both public and private sources. While there was considerable cooperation between the Department and

county extension agencies, there was a lack of well-defined policies for such cooperation, and there were large areas of operation and of organization in which it was functioning imperfectly, if at all. Yet under Dr. True's wise and sympathetic counsel, by 1917 a strong cooperative extension organization had been established in every State, and there had been settled in a large way the principles and methods for the successful and permanent establishment of the national system of extension work in agriculture and home economics in which Federal, State, and county forces cooperate closely and in which many thousands of farm men, women, and children participate year by year.

Hardly had the new organization become effective when the entrance of the Nation into the World War brought to it unforeseen heavy demands and vital responsibilities. The extension forces were called upon to expand tremendously almost overnight, and food production and conservation became outstanding objectives. Throughout the war the States Relations Service was one of the great civilian agencies of the Government, and its administration ranked among its most responsible key positions. Its efficient service, despite the handicaps of an excessive turnover of workers and other difficulties, meant much to the Nation and the Allied cause, and reflected corresponding credit upon those in charge.

The period of postwar readjustment again brought new problems, and a demand arose for the reorganization of the Department along more logical lines. Under the plan adopted the States Relations Service was dissolved and the position of director abolished. Dr. True had reached the age of retirement, so he was relieved of administrative responsibilities and given an appointment as specialist in states relations work. This development he accepted philosophically, seeing in it an opportunity to carry out a long-dreamed-of project for the compilation of a history of agricultural education and research in this country. From 1923 until his death he was engaged mainly in the preparation of this history, and was able to bring practically to completion a series of three publications. The first of these, dealing with the history of the extension work, was reviewed in these columns in the April issue. The second, the history of agricultural education in the United States, is in press, and the third, which deals with agricultural experimentation and research, including an account of the development of the Federal Department of Agriculture, is sufficiently advanced to be ready for publication in the near future. Thus there will shortly be available a complete trilogy such as no other hand could have prepared. Few men have possessed the power in greater measure "to think without confusion clearly," and none has been privileged to study more intensively and

from a national viewpoint the growth of the entire movement through the 40 eventful years in which he did his work.

Unique and timely as were Dr. True's services as a historian, however, it is doubtless his achievements as head of the Office of Experiment Stations and the States Relations Service that deserve to be longest remembered. He was not a mere passive spectator or scribe, but a maker of history—an active and influential participant in the upbuilding of agricultural education and research in this country. When he entered upon the task, the agricultural colleges of the Nation were still groping in uncertainty, with apparently little to teach and still less in common as to standards, accomplishments, or aims. The experiment stations were essentially isolated outposts, largely occupied with the needs of the hour and but meagerly prepared for more fundamental research, while the systematic cooperation of the Nation with smaller units in an extension service had not even been conceived of. Within the span of his working years a great national system arose and exceptional progress was achieved in all these directions. Many leaders, of course, have played their part in these developments, and the outcome has been the resultant of many factors, yet it may be conservatively said that by no single individual has the cause of agricultural education and research been better served or more permanently benefited than by the man who, in this critical period, most immediately represented the Nation in its dealings with the States along these lines.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

The biochemistry of the amino acids, H. H. MITCHELL and T. S. HAMILTON (*New York: Chemical Catalog Co., 1929, pp. 619, figs. 21*).—"The purpose of a review of any field of knowledge is only partly served by a description of the work that has been done in that field. . . . Any effective attempt to reconcile experimental results requires a critical consideration of them and of the methods by which they have been obtained. . . . In fulfilling the most useful function of a monographic review the judgment of the reviewer must . . . be exercised in appraising each investigation cited, in assessing its value and its significance."

The present monograph, No. 48 of the American Chemical Society series, takes the form of such a general critique as has been indicated in the statements above quoted. The chapters, each of which is divided into a considerable group of subheads, take up the various branches of the subject as follows: The physical and chemical properties of the amino acids; the determination of amino acids in proteins; the determination of the individual amino acids; the liberation of the amino acids in the intestinal tract; general amino acid metabolism—absorption and anabolism; general amino acid metabolism—catabolism and utilization as sources of energy; special phases of amino acid metabolism; the specific dynamic effect of amino acids; the endogenous catabolism; and the nutritive values of proteins and the protein values of foods in nutrition.

Studies on gossypol, I–IV, E. P. CLARK (*Jour. Biol. Chem., 75 (1927), No. 3, pp. 725–739; 76 (1928), No. 1, pp. 229–235; 77 (1928), No. 1, pp. 81–87, fig. 1; 78 (1928), No. 1, pp. 159–166*).—The four papers of the series here noted are concerned mainly with the chemistry of gossypol, secondarily with the toxic properties of this substance.

I. *The preparation, purification, and some of the properties of gossypol, the toxic principle of cottonseed.*—The molecular formula of gossypol as determined from analyses of a preparation of "analytical purity" was ascertained to be $C_{30}H_{30}O_8$. The extraction of the crude gossypol and its purification are described in some detail, as are also the preparation and properties of the derivatives anhydrogossypol, dianiline gossypol, gossypol dioxime, and acetyl gossypol. The dianilide was found to be a condensation product formed by the elimination of 2 molecules of water from 1 molecule of gossypol and 2 molecules of aniline, not a dianiline salt of gossypol as suggested (E. S. R., 38, p. 801) by Carruth.

"Of the 8 oxygen atoms in gossypol, 2 have been shown to be present as carbonyl groups, whereas the remaining 6 have been shown to be present as hydroxyl groups. Two of these hydroxyl groups behave differently from the remaining 4, being much more acidic and requiring drastic treatment for the hydrolysis of their acetyl derivative."

Acetyl gossypol was shown to be a hexaacetyl derivative.

II. *Concerning the nature of Carruth's D gossypol.*—The aniline derivative of Carruth's D gossypol (E. S. R., 39, p. 886) was found identical with the dianilide above noted, formed by condensation from aniline and gossypol; and,

when hydrolyzed, aniline D gossypol yielded a substance "shown to be identical both chemically and physiologically with analytically pure gossypol. . . . To explain the mechanism of the transformation of gossypol to D gossypol, it has been suggested that in the cooking and pressing process to which cotton seeds are subjected in the manufacture of cottonseed oil the gossypol present in the seeds is bound by condensing with free amino groups of the seed proteins, forming substances similar in type to dianiline gossypol."

III. *The oxidation of gossypol.*—On treatment of 5 gm. of gossypol dissolved in a solution of about 2 mols of sodium hydroxide in 200 cc. of water with 25 gm. of potassium permanganate in 400 cc. of water, both solutions having been cooled to 0° before mixing, a vigorous reaction of apparently short duration was observed. After the reaction mixture had been allowed to stand overnight the filtrate from the precipitated manganese dioxide yielded, upon acidification to Congo red wth sulfuric acd, carbon dioxide, and formic, acetic, and isobutyric acids. The last-named acid was obtained in the yield of 92.1 per cent of 1 mol of the acid per mol of gossypol, a result considered to indicate the presence in the gossypol molecule of a side chain consisting of at least the isobutyl group. The presence of formic and acetic acids was suspected from the nature of the distillation curve and was confirmed by qualitative tests. The quantities of these acids resulting from the decompostion were also determined.

IV. *Apogossypol.*—On treatment with 40 per cent sodium hydroxide at the temperature of the steam bath for half an hour gossypol was found to lose 2 carbonyl groups with the formation of sodium formate and a new phenolic substance designated apogossypol, the new compound having the empirical formula $C_{28}H_{30}O_6$. The 6 oxygen atoms remaining in the derivative were shown to be present in the form of hydroxyl groups by the preparation from apogossypol of a hexaacetyl ester and a hexamethyl ether. As in the case of gossypol, 2 of the hydroxyl groups yielded acetyl unions much more resistant to hydrolysis than were the other 4 acetyls. It was not possible directly to determine the methoxyl content of the methyl ether of apogossypol because of the entire failure of the ether to react with the boiling hydriodic acid of the usual Zeisel procedure.

The toxicity of the apogossypol was found to be considerably less than that of gossypol, and it differed in character from the toxicity of gossypol in that the apogossypol caused only acute toxication. Administered intraperitoneally to white rats, apogossypol showed the lethal dosage 60 to 75 mg. per kilogram of body weight.

Apogossypol itself was somewhat brownish as ordinarily prepared, but could be prepared in a colorless condition. It was without a definite melting point. Apogossypol hexaacetate crystallized in large colorless rods and melted at 291° (corrected) after softening at 285° C. The hexamethyl ether formed colorless spindle-shaped crystals melting at 259° (corrected). The optical properties of the 2 derivatives are also given.

The production and physical properties of the cellulose acetates, V. E. Yarsley (*Über die Herstellung und Physikalischen Eigenschaften der Celluloseacetate. Thesis, Eidg. Tech. Hochsch., Zurich, 1927, pp. 48, figs. 4*).—This thesis discusses in considerable detail Chardonnet silk, the copper oxide-ammonia process, the viscose silk process, the acetate silk process, the properties of cellulose acetate solutions, the preparation of primary and secondary cellulose acetates and their properties, the determination of the acetic acid content and the chemically bound sulfuric acid content, the preparation of acetone solutions of cellulose acetate, viscosity determinations, and some other subjects connected with the preparation and use of the acetylated celluloses. Experimental work of the laboratory type and of a semimanufacturing scale is also described.

Studies in enzyme action, I, II (*Jour. Indian Inst. Sci., 11A (1928), No. 11, pp. 121–139, pls. 13*).—Two papers are presented.

I. *Amylase from cholam* (*Sorghum vulgare*), V. N. Patwardhan and R. V. Norris (pp. 121–133).—From a detailed comparison of malted cholam amylase with the enzyme from malted barley the authors obtained results supporting the conclusion that the cholam enzyme, though relatively inactive in sugar production, is more active with respect to its power of liquefying starch than is the barley enzyme.

"The variation in the ratio of the saccharifying and liquefying powers of the enzymes obtained from different sources supports the view that each action is brought about by a separate enzyme, the proportion in which the two enzymes occur varying in different grains. Attempts to effect a change in this ratio, i. e., to bring to bear a selective influence on either enzyme, by varying the experimental conditions, have given negative results. Variations in temperature of reaction and in salt content, within the limits investigated, have affected both liquefaction and saccharification to the same degree."

II. *The nature of amylase*, D. Narayanamurti and R. V. Norris (pp. 134–139).—An electrodialysis of cholam malt amylase was found considerably to increase its activity. The electrodialyzed preparation of the enzyme did not respond to any of the usual protein reactions, but did give a strongly positive Molisch reaction. Electro-osmosis separated the cholam malt amylase into two enzymic fractions, of which one was found a good saccharifier, the other "a powerful liquefier."

Studies on the oxygen-supplying power of the soil, together with quantitative observations on the oxygen-supplying power requisite for seed germination, L. M. Hutchins (*Plant Physiol., 1 (1926), No. 2, pp. 95–150, figs. 9*).—"The studies reported in the present paper have resulted in making available an exceedingly sensitive, practical method for comparing the oxygen-supplying powers of different environments. The method is based essentially on a colorimetric determination of the time required to produce a standard color change in an alkaline aqueous solution of pyrogallol, by the absorption of the oxygen brought to the indicator in a continuous stream of gas, this oxygen having been absorbed from the environment in question by a very thin-walled, water-impregnated, porous porcelain conical-shaped absorber that has capacity for absorbing oxygen and delivering it to the gas stream at least as rapidly as that element is supplied to the absorbing surface by the surroundings. The numerical results, called here indices of the envrionmental oxygen-supplying power, are expressed as milligrams of oxygen as supplied per hour through a square meter of absorbing area exposed to the environment in question."

The results obtained from comparisons made with absorbers placed at different depths in soils of different moisture contents and degrees of packing are considered to prove that the oxygen-supplying capacity of the soil environment is greater near the soil surface and in the drier, more loosely packed soils, which conditions are particularized along with probabilities. Results and bearings are discussed.

The apparatus and method devised for this work are thought to be adequate for experimental study of the dynamics of the soil-oxygen aspects of ecology and agriculture and valuable in many lines of research dealing with soil organisms as well as with plant roots. The general principles involved should also have wide applicability.

Surface energy studies, D. S. Jennings (*Utah Sta. Bul. 209 (1929), pp. 80, 81*).—Particles of the mineral apatite more than 0.1 mm. in diameter gave a phosphate ion solubility of 0.198 part per million, but particles of a diameter

of from 0.005 to 0.001 mm. showed a phosphate ion solubility of 1.1 parts per million. "These values would give a solid-liquid surface tension for the water apatite surface of about 7,200 ergs per square centimeter. That is, the energy change, in the appearance or disappearance of a square centimeter of the water apatite surface, is between 7,000 and 8,000 ergs."

A shaker for Clark hydrogen electrode vessels, D. H. CAMERON and R. SHEARER (*Jour. Amer. Leather Chem. Assoc.*, *24 (1929), No. 3, pp. 130–133, figs. 2*).—"The accompanying diagram shows a simple and easily constructed mounting which will carry two Clark cells and permit the manipulation of the stopcocks of both cells, a thing which is difficult when the two cells are mounted side by side as in the conventional apparatus furnished by the supply houses." An illustrated working description is given.

A jar proof galvanometer mounting, D. H. CAMERON and R. SHEARER (*Jour. Amer. Leather Chem. Assoc.*, *24 (1929), No. 1, pp. 43–46, figs. 2*).—Essentially the apparatus here described and figured consists of a simply constructed frame or carriage fitted to the galvanometer and supported from above and from below by groups of heavy rubber bands attached to arms clamped to a rigid vertical support, which may consist of a piece of iron pipe of suitable diameter set in a flange screwed to the table top. Provision is made for a simple adjustment of the tension of the elastic suspension system.

Methods for determining the hydrogen-ion concentration of soils, E. F. SNYDER (*U. S. Dept. Agr. Circ. 56 (1928), pp. 30, figs. 4*).—Electrometric and colorimeteric methods for the determination of the H-ion concentration of soils, including the hydrogen, quinhydrone, and antimony electrodes, and numerous colorimetric methods, are described in detail. Such factors affecting the H-ion concentration of soils as the periodic variation of H-ion concentration, drying, grinding, the soil-water ratio, carbon dioxide, and the methods of obtaining the soil extract are discussed, together with such other incidental data as will be helpful in the determination of the H-ion concentration of soils.

A new method of making up molybdic acid solution for use in phosphoric acid determinations, J. F. BREAZEALE (*Chemist-Analyst, 18 (1929), No. 2, p. 4*).—Noting the difficulty often experienced in dissolving molybdic acid in diluted ammonia by reason of the caking or lumping of the acid, the author of this contribution from the University of Arizona states that "this difficulty may be obviated by a very simple procedure. Measure out 144 cc. of strong ammonia and 271 cc. of water, as directed by the Official methods. Weigh out 100 gm. of molybdic acid, and add a part of the 271 cc. of water to the acid, or enough to make a thin magma. Add the rest of the water to the ammonia, and then add the diluted ammonia to the acid mixture. If the acid is first moistened, it will not cake when the dilute ammonia is poured upon it, and it will go into solution readily."

Some factors affecting the adsorption of quinine, oxalate, and glucose by fuller's earth and norit, N. B. GUERRANT and W. D. SALMON (*Jour. Biol. Chem.*, *80 (1928), No. 1, pp. 67–89, figs. 4*).—As a result of a study of the effect of H-ion concentration, particle size, heat treatment of the adsorbent prior to making of the adsorption tests, electrodialysis of the adsorbent before use, and preparation of the adsorbent by preliminary extraction with hot acid solutions, the authors of this communication from the Alabama Experiment Station conclude that the various fuller's earths vary in adsorptive capacity by reason of differences both in composition and in state of division; that H-ion concentration has an important influence on adsorption of electrolytes, and may, under certain conditions, affect also the adsorption of nonelectrolytes; and that the degree of dispersion of the adsorbent is of more importance in apolar than in polar adsorption.

The heating of fuller's earth at red heat for 30 minutes but slightly altered its adsorptive capacity either for the oxalate ion or for glucose. The adsorptive capacity of fuller's earth with respect to quinine was slightly reduced by previous electrodialysis. A prior digestion with hot mineral acid, however, reduced the subsequent adsorption of quinine to one-half, that of the oxalate ion to one-sixth; whereas the treatment had but little effect on the subsequent adsorption of glucose. The acid-treated earth recovered much of its adsorptive capacity for quinine as a result of electrodialysis, but the subsequent adsorption of the oxalate ion and of glucose by the acid-treated fuller's earth appeared but little affected by electrodialysis following the acid extraction.

Perchloric acid as an agent for the clean destruction of organic matter, R. J. C. FABRY (*Chemist-Analyst, 18 (1929), No. 2, p. 8*).—Nitric acid and 20 per cent perchloric acid in the proportions 3:2 made a much more satisfactory oxidizing agent for the destruction of organic matter in certain analytical operations than did the usual mixture of sulfuric and nitric acids. The reaction was found to proceed without initial violence such as was encountered in the use of sulfuric and nitric acids, and was more rapid in reaching completion.

The chemical analysis of plant tissues, W. E. TOTTINGHAM ET AL. (*Plant Physiol., 1 (1926), No. 4, pp. 397–402*).—This report of the committee on methods of chemical analysis for the American Society of Plant Physiologists outlines the purposes and plan in view, presenting, however, only general principles of certain phases of the analysis and outlining their recommendations in regard to sampling, extraction, desiccation, lipoid removal, moisture determination, and expression of results.

The adaptation of certain colorimetric methods to the estimation of nitrates, phosphates, and potassium in plant solutions, B. E. GILBERT (*Plant Physiol., 1 (1926), No. 2, pp. 191–199*).—Methods of determining the fertilizer requirements and utilization by individual crops as hitherto in use, involving the investigation of the content and availability of the nutrient elements in the soil and the determination of the total content of nitrogen, phosphorus, and potassium within the plant, have failed to furnish a satisfactory basis for determining the mineral nutrient needs of plants, due to the very large number of factors involved in crop production, especially with reference to the relationship between the plant and the soil. In this paper, summarizing work carried on during 1925–26, a different mode of attack is suggested as of possible value in such work, as also in studies of mineral nutrient metabolism.

It was found that the usual chemical microscopical tests were incapable of use in the work of establishing low, medium, and high nutrient levels in crop plants. The methods found to be applicable to determinations with plant solutions were for nitrate-nitrogen, the phenol disulfonic acid method; for phosphate-phosphorus, the coeruleo-molybdate method; and for potassium, the reduced chloroplatinate method. The application of these methods to the establishment of optimum nutrient levels of the three fertilizer elements within the plant as indicative of a normal crop is discussed.

Notes on the iodimetric determination of glucose, V. A. TOSCANI (*Chemist-Analyst, 18 (1929), No. 2, p. 7*).—In determining glucose by oxidation with standard alkaline ferricyanide the author of this note found it necessary, in order to secure the completion of the liberation of iodine by the excess ferricyanide so that the determination might be completed by thiosulfate titration of the liberated iodine, to precipitate the ferrocyanide as formed by the addition of 3 cc. of a reagent composed of 5 gm. of potassium iodide, 50 gm. of sodium chloride, and 10 gm. of zinc sulfate made up to 200 cc. with distilled water.

Ordinary starch solution failing to give a clear solution at the end point, the author obtained satisfactory starch indicator solution, which did not cloud at the

end point, by the following procedure: "One gm. of soluble starch is taken in a mortar and enough saturated salt solution is added to make a paste. When the paste is ready, 100 cc. of a hot saturated solution of sodium chloride is added. It will be found that such a solution does not cloud and gives a very sensitive reaction with iodine."

SOILS—FERTILIZERS

[Soil Survey Reports, 1923 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1923, Nos. 29, pp. 929–957, pl. 1, fig. 1, map 1; 31, pp. II+1013–1042, fig. 1, map 1; 33, pp. 1095–1121, fig. 1, map 1; 34, pp. 1123–1159, pls. 3, fig. 1, map 1; 36, pp. 1183–1202, fig. 1, map 1*).—These reports deal with the soils of Antrim, Macomb, and Isabella Counties, Mich.; Walworth County, S. Dak.; and Lawrence County, Mo., the surveys having been conducted in each instance in cooperation with the corresponding State experiment station.

No. 29, by J. O. Veatch et al.—Antrim County, Mich., has a total area of 311,040 acres, of which about 32,000 acres consist of lake surface. Glaciation has developed a widely varied topography; and the drainage system is composed of but few streams, small and short, about 13 per cent of the county being swampy or almost always wet.

The soils classified in the present report consist of 16 series, including 19 types, the more extensive of which are Emmet sand 23.2 per cent of the total area of the county, Rubicon sand 20.2 per cent, Onaway sandy loam 14.1 per cent, and Emmet sandy loam 11.1 per cent. Tables showing the soils in relation to the native vegetation and the classification of the land are included.

No. 31, by R. Wildermuth et al.—Macomb County, Mich., comprises 309,120 acres in the southeastern part of Michigan, consists mainly of an old lake-bed plain, and varies in surface features from level to gently undulating. The greater part of the county is well drained, but there are considerable areas of poorly drained land.

The soils mapped consist of 23 types classified into 14 series, the important type areas being those of Conover loam 17.1 per cent of the surface included in the survey, Nappanee loam 14.5 per cent, Brookston loam 14.1 per cent, and Berrien loamy fine sand 10.7 per cent. Unclassified areas of muck 0.5 per cent, and marsh 0.5 per cent, were also found.

No. 36, by J. A. Kerr and F. W. Trull.—Isabella County, Mich., central in the south peninsula of the State, contains 366,080 acres of land, the topographic features of which are of glacial origin. The drainage is in general adequate.

The more extensive types of soils found are Isabella sandy loam 21.3 per cent of the total area of the county, and Isabella loam 21.1 per cent. In all, 15 types were recognized and assigned to 10 series. Muck and peat, 8.4 per cent, constitute the miscellaneous areas in this county.

No. 33, by J. A. Machlis and G. A. Larson.—Walworth County, in north-central South Dakota, contains 469,120 acres of the Wisconsin ice-sheet region of the Great Plains, and consists of morainal hills and ridges, undulating drift areas, and the Missouri River Valley flood plains and terraces. The county as a whole is well drained.

The soils mapped and described comprise 20 types representing 10 series, the areas of important extent being those of Williams silt loam 48.7 per cent and of the unclassified tracts of rough stony land 14.4 per cent. Other unclassified groups are dunesand 0.1 per cent, marsh 1.5 per cent, and riverwash 0.5 per cent.

No. 34, by A. T. Sweet and H. V. Jordan.—Lawrence County, southwestern Missouri, consists of an area of 395,520 acres of predominantly undulating or

gently rolling land, generally well drained. Its soils consist of a total of 20 types here classified in 11 series, Baxter gravelly loam, 26.6 per cent, and Eldon gravelly silt loam, 11.2 per cent, constituting the important individual types. Rough stony land, not classified, was found to the amount of 0.2 per cent of the entire county.

[Soil Survey Reports, 1924 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1924, Nos. 3, pp. III+63–95, pls. 3, fig. 1, maps 2; 6, pp. 30, fig. 1, map 1; 7, pp. 48, fig. 1, map 1; 8, pp. 44, fig. 1, map 1; 9, pp. 40, fig. 1, map 1; 10, pp. 24, fig. 1, map 1; 11, pp. 31, pl. 1, fig. 1, map 1; 12, pp. 56, fig. 1, map 1; 13, pp. 34, fig. 1, map 1; 14, pp. 20, fig. 1, map 1; 16, pp. 45, fig. 1, map 1*).—This group of reports of the series of 1924 deals with the surveys, made in cooperation with the corresponding State experiment stations except as otherwise noted, of the Bishop area of California; Hillsdale and Barry Counties, Mich.; Fremont, Jones, and Cherokee Counties, Iowa; Buffalo County, Nebr.; Worcester County, Md.; Harrison County, Miss.; Greene County, N. C.; and Randolph County, Ga.

No. 3, by E. B. Watson and R. E. Storie.—The Bishop area of California amounts to 190,080 acres, lies almost entirely in the northern part of Inyo County, and forms part of the rift valley on the east side of the Sierra Nevada. Although located in a desert region the area surveyed is well watered, but drainage is poor in a large part of it.

Land of practically no agricultural value was found in the present survey to occupy 50.2 per cent of the area, and the largest single soil group recorded is that of scab land, 14.8 per cent. Cajon stony sand constitutes, with the inclusion of a bowlder phase, 11.3 per cent of the lands surveyed and is the largest single type among the 22 here mapped and described in 12 series. Unclassified lands other than scab land above noted consisted of rough broken land, 4.5 per cent, and rough stony land, 9.3 per cent.

No. 10, by J. O. Veatch et al.—Hillsdale County, Mich., occupies 384,640 acres of glaciated upland at the southern boundary of the State, and possesses in general a gently rolling to moderately hilly surface. Most of the county is well drained, but something over 19 per cent of the area consists of muck soils and peat bogs without adequate natural drainage.

A total of 19 soil types and 14 series were recognized in the present survey. The extensive types are Hillsdale sandy loam, 30.5 per cent, and Miami loam, 22.2 per cent, of the county area.

No. 14, by E. B. Deeter and F. W. Trull.—Barry County, Mich., comprises 357,760 acres of level to hilly lands in the southwestern part of the State, and with the exception of two small areas near Gun Lake is well drained. The surface features are of glacial origin. The more extensive of the 22 soil types of 17 series found in the survey here reported are Bellefontaine sandy loam with 34.8 per cent, and Miami loam 23.2 per cent, of the total acreage of the county.

No. 8, by C. L. Orrben and L. S. Paine.—Fremont County, Iowa, total acreage 328,320 acres, shows topographic features resulting from the erosion of an originally level plain and has a drainage system of such a nature as to cause a considerable run-off damage.

Marshall silt loam, 33.1 per cent of the surface included in this survey, and Wabash silt loam, amounting, with the inclusion of its colluvial phase, to 15.8 per cent, are prominent among the 21 types here mapped and described as 11 series. Riverwash areas, aggregating 2.5 per cent of the lands studied, are also listed, unclassified.

No. 9, by A. M. O'Neal and R. E. Devereux.—Jones County, eastern Iowa, covers 364,160 acres of drift and loess plain "thoroughly dissected by a complete drainage system."

As mapped and described in the present report, the soils of Jones County consist of 28 types representing 16 series, Clinton silt loam 34.5 per cent, Carrington silt loam 15.7 per cent, and Tama silt loam (with the inclusion of a light colored phase) 12.5 per cent, constituting the important portions of the surface here considered as individual types. Meadow, 1.0 per cent, is listed unclassified.

No. 13, by D. S. Gray and B. H. Hendrickson.—Cherokee County, of northwestern Iowa, consists physiographically of a comparatively smooth plain somewhat modified by erosion, for the most part provided with good natural drainage, and has an areal extent of 366,720 acres.

Of this total area, 70.8 per cent is occupied by Marshall silt loam, the only type among the 23 here classified into 14 series, which has an important aggregate extent. Pits, 0.1 per cent of the total surface, constitute the unclassified soil area in Cherokee County.

No. 12, by F. A. Hayes et al.—Buffalo County is located in south-central Nebraska, and comprises 611,200 acres of a broad plain underlain by loess and considerably modified in surface features by stream erosion and wind action, the county as a whole being well drained.

The important soil areas of the county as indicated in the present report are Holdrege silt loam 33.3 per cent of the total area, Colby silt loam 17.9 per cent, and Waukesha silt loam 13.3 per cent; dunesand 1.2 and riverwash 0.3 per cent being noted as the unclassified tracts. The report names a total of 27 types assigned to 12 series.

This survey was made in cooperation with the University of Nebraska State Soil Survey Department of Conservation and Survey Division.

No. 11, by S. O. Perkins and S. R. Bacon.—Worcester County, Md., occupies 316,800 acres in the extreme southeastern part of the State, and comprises physiographic divisions designated, respectively, as mainland, coastal beach, marshes, and fresh-water swamps. Throughout a large part of the county natural drainage has not been established.

Tidal marsh 8.1 per cent, coastal beach 2.5 per cent, and swamp 7.7 per cent, include collectively a larger proportion of the surface surveyed than does any single arable soil type. Elkton silt loam, 15.5 per cent, is the most extensive of the 18 classified types and 5 series observed.

This survey was made in cooperation with the Maryland Geological Survey and the Maryland Experiment Station.

No. 7, by R. Wildermuth et al.—Harrison County, southeastern Mississippi, constitutes an area of 372,480 acres, consisting physiographically of three divisions of low, generally level country, or flatwoods, a higher inland division, and uplands in which erosion has produced an uneven surface. Drainage is good in much of the uplands, but many seepage basins exist even in this part of the county.

The soils of Harrison County are here classified as 18 series inclusive of 31 types, of which Norfolk fine sandy loam, 29.4 per cent of the tract surveyed, constitutes the one classified soil of large areal extent. Unclassifiable areas of tidal marsh 2.8 per cent, muck 0.5 per cent, beach sand 0.6 per cent, and dunesand 0.2 per cent were also found, forming a total of 4.1 per cent, exclusive of water surface.

This survey was conducted in cooperation with the Mississippi Geological Survey.

No. 6, by S. O. Perkins and H. G. Lewis.—Of a flat to undulating or gently rolling surface, Greene County, east-central North Carolina, has an area of 169,600 acres, of which some 60 per cent is provided with adequate natural drainage though by "rather sluggish" streams. Certain of the flat lands, though higher than most of the surrounding soils, together with all of the first-bottom and some of the second-bottom lands, have but poor natural drainage.

Areas of Norfolk fine sandy loam, aggregating 28.0 per cent of the surface surveyed, and of Plummer fine sandy loam, amounting to 13.8 per cent, are the prominent types among the 24 found in the survey and classified as 11 series, together with unclassified tracts of 6.5 per cent of swamp and 4.4 per cent of meadow.

This survey was made in cooperation with the North Carolina Department of Agriculture and the North Carolina Experiment Station.

No. 16, by S. W. Phillips et al.—Randolph County, 279,040 acres in southwestern Georgia, forms a nearly flat to gently undulating plain, broken by numerous flat-bottomed depressions and low ridges, and is well drained only in the northern and western part of the county, the southern and southeastern parts having many ponds or limestone sinks which hold water at least part of the year. Swamps up to one-half mile in width border the larger streams.

In order of areal importance the soils found are Norfolk sand 14 per cent; unclassifiable tracts consisting of swamp 5.5 per cent, rough gullied land 2.0 per cent, muck 0.3 per cent, and meadow 5.4 per cent; Greenville sandy loam 11.4 per cent; and Orangeburg sandy loam 10.6 per cent.

This survey was made in cooperation with the Georgia State College of Agriculture.

[Soil Survey Reports, 1925 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1925, Nos. 1, pp. 21, fig. 1, map 1; 2, pp. 38, fig. 1, map 1*).—The two surveys here noted are those dealing with Lamar and Calhoun Counties, Ga., prepared in cooperation with the State College of Agriculture.

No. 1, by S. O. Perkins et al.—Lamar County constitutes a generally well-drained area of 116,480 acres, undulating or rolling in surface relief, in the west-central part of the State. The soils consist of Cecil sandy loam 33.8 per cent, Cecil sandy clay loam 34.3 per cent, Appling sandy loam 12.5 per cent, and other less extensive soils to a total number of 10 types representing 6 series, together with unclassified meadow surface as 6.6 per cent of the entire area.

No. 2, by J. W. Moon and H. G. Lewis.—Calhoun County consists of an area of 183,680 acres, mostly part of a low plain marked by numerous limestone sinks, in southwest Georgia. Some rolling land was found in the northwestern part of the county. Good drainage occurs throughout a large part of the area, but much swamp was found along the larger streams.

The more extensive soil areas recorded are those of Norfolk sandy loam 14.5 per cent, unclassified swamp 12.7 per cent, Greenville sandy loam 12.6 per cent, Greenville clay loam 11.7 per cent, and Orangeburg sandy loam 10.0 per cent.

Morgan County soils, R. S. Smith, E. E. DeTurk, F. C. Bauer, and L. H. Smith (*Illinois Sta. Soil Rpt. 42 (1929), pp. [2]+64, pls. 2, figs. 13*).—Morgan County includes an area of 365,241 acres in west-central Illinois, in part well drained, and in part so nearly level that the surface drainage is not good and dependence must be placed upon underdrainage.

The soils of this tract are divided in the present report into the regional groups of upland prairie, upland timber, terrace, and swamp and bottom-land soils. The types important in areal extent are given as an upland timber group

yellow-gray silt loam, 29.92 per cent of the total surface surveyed; an upland prairie brown silt loam, 28.52 per cent; an upland timber yellow silt loam, 14.0[illegible] per cent; and an upland prairie black clay loam, 10.26 per cent. Water surface occupies 0.43 per cent of the total area of the county.

Special investigations (*Oregon Sta. Bien. Rpt. 1927–28, pp. 75, 76, 77*).—In studies of the improvement of permeability in heavy-textured soils, sulfur has aided flocculation of alkali soil, and lime and manure have been most helpful on acid soil. Certain peat soils are reported improved by manure, potassic fertilizers, and lime, and especially by potassium nitrate. Potassium seemed to be the most important nutrient for increasing the length, value, and quality of flax fiber.

One part per million of iodine increased the yield of head lettuce, but two parts or more proved toxic.

In a study of replaceable bases in some Oregon soils, acid soils were found liable to a low replaceable calcium content because of the replacement of this element by hydrogen and loss of the calcium by leaching. The heavier soil types appeared to have greater basic capacity, but not necessarily a larger actual quantity of replaceable bases. The neutral soils showed a tendency toward higher replaceable calcium content and productivity.

A study of the soil profile at the Astoria Substation showed a low exchangeable calcium content even in the weathered soil material in the substratum, low exchangeable calcium correlating with high acidity. Liming was found of primary importance, other treatments having had little effect on the soil reaction.

[Organic matter in Michigan County soils], M. M. McCool and J. O. Veatch (*Michigan Sta. Circs. 108–116 (1929), pp. 6, fig. 1, each*).—With the exception of the soil map of the individual county, identical general information is given in these circulars for Berrien, Ingham, Kalamazoo, Ottawa, Van Buren, Calhoun, Livingston, Hillsdale, and Macomb Counties. This includes the summary statement that "practical experience and scientific experimentation have demonstrated that deficiencies in humus and nitrogen may be corrected by the following methods separately or in combination: (1) By the addition of animal manures to the land; (2) by green manuring, particularly the turning under of leguminous crops or the residues of such crops; [and] (3) by the use of commercial fertilizers carrying nitrogen." Individual leguminous crops useful for this purpose are briefly discussed.

[Distribution of acid soils in Muskegon, Jackson, Hillsdale, Ingham, Kent, and Tuscola Counties, Mich.], J. O. Veatch (*Michigan Sta. Circs. 117–122 (1929), pp. 6, figs. 4, each*).—It is estimated that from 85 to 90 per cent of the total soil area of Michigan is acid in reaction, at least in the surface soil; and liming is stated to have an important place in Michigan farming practice. Other general information, identically stated in each of these circulars, is also given. The circular for each county contains a map showing the general distribution, in four degrees of acidity, of the acid soils of the county. Muck soils where present are also indicated in these maps.

Alkali land reclamation (*Oregon Sta. Bien. Rpt. 1927–28, p. 74*).—Alkali reclamation work of the usual type is reported in brief summary from the Vale alkali experiment field. Various treatments have eliminated from one-fourth to three-fourths of the alkali salt content of the soil, elementary sulfur having been the most effective single treatment. Several alkali-resistant grasses and legumes have been established on this soil.

Report on drainage tanks D. S. Jennings (*Utah Sta. Bul. 209 (1929), p. 80*).—Experiments on the improvement of the drainage of heavy clay soils by calcium chloride treatment have indicated the application of 1¼ tons per

acre as sufficient for the reclamation of the first foot, and 2⅔ tons for the second foot.

Soil factors influencing crop production in the Arkansas Valley, Colorado, A. T. SWEET (*U. S. Dept. Agr. Circ. 55 (1928), pp. 25, figs. 14*).—Serious problems reported as found in the Arkansas Valley region are the rapid burning out of the humus under present climatic conditions, deflocculation by loss of humus and the use of alkali-bearing irrigation waters, loss of moisture capacity and bad soil structure caused by overirrigation and wet cultivation, the development of seep and alkali areas, and the expenditure of labor and irrigation water which should be applied to available high-grade soils upon soils of poor grade. Well-known methods are considered adequate for the solution of all except the last stated of these problems.

[**Soil microbiological investigations**] (*Oregon Sta. Bien. Rpt. 1927–28, pp. 81–84*).—Experiments on the soil method nitrification test showed that in a well drained silty clay loam well supplied with organic matter tests consisting in the nitrification of ammonium sulfate with or without the addition of calcium carbonate and the nitrification of 0.1 per cent additions of blood meal agreed closely, but on a light, arid medium sand at the Umatilla Substation the same quantities and kinds of nitrogenous materials did not give consistent results. Smaller quantities of ammonium sulfate and shorter incubation periods were satisfactory for determining the nitrifying powers of these soils.

A study of nonsymbiotic nitrogen fixation at the main station indicated the absence of Azotobacter at all soil reactions in spite of 14 years of fertilizer treatments. The nitrogen-fixing power of this soil was low.

Experiments on the effect of wheat straw, alfalfa, and green kale added to Willamette silty clay loam showed all the organic additions to have a marked depressing effect on the soil nitrate content, the depression having lasted longest after the wheat straw treatment. Following the application of the alfalfa or the kale the effect was of short duration.

The amino nitrogen content of cultures on synthetic media of legume bacteria and of Azotobacter increased "with the age of the culture up to a given point." Tests indicated the presence of tyrosine or other oxyacids in all of the cultures studied. Nitrites or nitrates were not found to be produced at any stage in vigorously growing cultures. "The fact that an accumulation of ammonia always occurs in the cultures during the first few days of maximum growth and gradually diminishes as the available carbohydrate is reduced leads to the conclusion that ammonia is probably the first product of metabolism in the nitrogen fixation, and that a balance is reached quickly within the cells in which the ammonia is formed no faster than it is synthesized into protein."

Permanent fertility studies, J. E. GREAVES (*Utah Sta. Bul. 209 (1929), pp. 52, 53*).—The investigation of active nitrogen fixation in soils devoid of Azotobacter has been noted from another source (E. S. R., 59, p. 815.)

The limiting element in most of the arid soils of the West was found to be nitrogen. Many of these soils were observed to be capable of a gain of 30 lbs. per acre of nitrogen annually from nonsymbiotic nitrogen fixation. In pot experiments in the greenhouse a moisture content of about 70 per cent, basis of the moisture-holding capacity, was indicated as optimal for nitrogen fixation, and either barnyard manure or plant residues greatly increased the nitrogen-fixing capacity of the soil flora. An average gain of 45 lbs. per acre annually of nitrogen was observed in 11 years of treatment of field soils with 5 tons of manure per acre per year, the gain recorded being exclusive of nitrogen added in the manure and determined without regard to nitrogen lost in the drainage.

Value of manure *(Oregon Sta. Bien. Rpt. 1927–28, p. 117).*—Barnyard manure applied to plats of alfalfa at the rate of 48 and 192 tons per acre during six years of the past 13 continued to increase the yields over plats not receiving manure. The lighter application has given much larger returns per ton of manure than the heavier one.

The effect of fertilizers on various properties of a highly calcareous soil and on the yield and quality of the crops produced, D. W. PITTMAN and G. STEWART *(Utah Sta. Bul. 209 (1929), pp. 35, 36).*—Added nitrogen increased sugar beet and wheat yields in greenhouse tests on this soil, but "subsequent studies showed that the conditions in this greenhouse were favorable to rapid bacteriological nitrate consumption, so this may not be significant." Only ammonium sulfate or sodium nitrate gave noticeable results on lawns, and only superphosphate on alfalfa.

Soil fertility investigations *(Oregon Sta. Bien. Rpt. 1927–28, pp. 70, 71, 72, 73).*—Alfalfa hay was found increased by from 1 to 2 tons per acre at a cost of about $1 per acre per year by treatment with elementary sulfur, and in some arid soils both the sulfate and the calcium contents of the soil solution were increased by the sulfur treatment. Sulfur also frequently improved, for alfalfa, the reaction of arid soils.

Tests in the Willamette Valley indicated phosphatic fertilizers in conjunction with manure as probably profitable on worn-out grain lands. In western Oregon soils liming and the maintenance of organic matter by means of green manures and barnyard manure assisted in maintaining available phosphate. Best results from barnyard manure were obtained at the application rate of 10 tons per acre and in combination with lime or phosphate. Legumes, green manures, and barnyard manure aided in obtaining penetration by irrigation water in heavy soils.

Potassium was found a requirement of much of the peat soil of the State, and "a very important nutrient for increasing the length and value of fiber flax." It was shown also that "full returns may not be expected from potash unless nitrate is present to accompany the potassium into the plant root."

Nitrate has been found lacking in the western Oregon soils. Sodium nitrate is considered the best treatment for those showing an acidity tendency, whereas ammonium sulfate was the more effective on neutral or alkaline heavy soils where sodium salts tended to cause alkali trouble.

Liming western Oregon soils, R. E. STEPHENSON and W. L. POWERS *(Oregon Sta. Bul. 237 (1928), pp. 20, figs. 7).*—A general account of soil acidity and liming is followed by specific recommendations with respect to the treatment of the humid soils of western Oregon. A soil acidity map shows that only the western third of the State, approximately, has soils usually or frequently acid. Specifications for a home-made limestone spreader are included.

Sulphur and phosphorus *(South Dakota Sta. Rpt. 1928, p. 5).*—In the pot culture experiments reported double superphosphate produced the largest growth; rock phosphate experiments are now producing better yields than when the pots first received the rock phosphate, although the yields remain small; and a sand series inoculated with a soil infusion is producing better than a corresponding sand series not inoculated.

Inspection of commercial fertilizers for the season of 1928, H. D. HASKINS, H. R. DEROSE, and M. W. GOODWIN *(Massachusetts Sta. Control Ser. Bul. 45 (1928), pp. 47).*—In addition to the usual analytical information, this bulletin contains data on the relative sales of the New England Standard Nine, pot-culture experiments on 23 organic sources of nitrogen, "including all of the processed low-grade nitrogen materials that could be secured through trade channels," and other information relating to commercial fertilizers.

Analyses of commercial fertilizers and ground bone; analyses of agricultural lime, 1928, C. S. CATHCART (*New Jersey Stas. Bul. 481 (1928), pp. 29*).—The usual analyses of commercial fertilizers, ground bone, and agricultural lime are given, continuing previous reports (E. S. R., 60, p. 624), together with some information on commercial valuation and basis for purchase.

Commercial fertilizers, L. S. WALKER and E. F. BOYCE (*Vermont Sta. Bul. 287 (1928), pp. 24*).—The usual analytical data are given, together with some discussion of trends in sales of fertilizer materials in the State. Ninety-six per cent of the brands licensed were of "high analysis" (over 14 per cent plant food), and plant food was much cheaper in the high-analysis grades.

AGRICULTURAL BOTANY

Growth of young wheat plants in auto-irrigated soils, as related to the water-supplying power of the soil and to the adjustment of the auto-irrigator, B. E. LIVINGSTON, T. HEMMI, and J. D. WILSON (*Plant Physiol., 1 (1926), No. 4, pp. 387–395, fig. 1*).—The experimentation herein briefly described, said to have been carried on by Hemmi, was planned as a preliminary study of the relations between the growth of young wheat plants in auto-irrigated pot cultures and the water-supplying power of the soil about their roots. This dynamic soil feature was itself controlled, for each kind of soil used, by the water content of the soil, controlled in turn by the height of the mercury column introduced between the irrigator reservoir and the water-supplying, porous-porcelain cone. The results, which are presented in tabular and graphical form with discussion, were published for their supposedly significant bearing upon practice.

The water-supplying capacity consistently follows the water content in the case of each soil, though these two properties are not proportional. "The auto-irrigator, the soil point method, and the method for determining the oxygen-supplying power of the soil should all be valuable in the development of this very important portion of the field of plant physiology and physiological ecology. In spite of the considerations suggested . . . it remains clear that the water-supplying power of the soil was, in general, of primary importance in determining the growth of our wheat plants. If the 15 different treatments are arranged in the descending order of green-weight values it becomes clear that the highest 5 growth indices are for the range of water-supplying powers from very high to 160 (humus-loam mixture), while the lowest 4 growth indices are for the range of water-supplying powers from 170 to 60 (sand-loam mixture)."

Temperature effects in the metabolism of wheat, W. E. TOTTINGHAM (*Plant Physiol., 1 (1926), No. 4, pp. 307–336, figs. 3*).—Improvements are described as made in the apparatus previously employed (E. S. R., 50, p. 20) to fit it for use in the present work to control environmental factors in wheat plant growth. An account is given also of the methods of estimating the total illumination effective from sun and electric lamps. Details are given of the work and its results with nine series of wheat cultures in water, sand, and soil. Each series was subjected to temperature at two levels, but with uniform illumination and atmospheric humidity.

Apparently atmospheric humidity exercises little influence on the increment of protein content during seed development. With supposedly deficient illumination lower temperatures favored the production of dry matter, as if conserving limited supplies of photosynthetic products. Under these conditions the lower temperature generally favored both the percentage and the total of protein in the tissues. Failure of seed formation in plants thus closely confined

appears to be due chiefly to unfavorable conditions for pollination. With illumination supposedly adequate as regards intensity, young wheat plants developed greater percentages of sucrose and protein when grown at lower temperatures. Mature plants gave increased carbohydrate percentages and yields, especially of grain at the lower temperatures. The higher sugar content at lower temperatures apparently favors protein synthesis, but at higher temperatures deficiency of nitrate supply seems to operate as a limiting factor. Although the protein synthesis is less at the higher temperatures its percentage is greater, supposedly due to greater respiratory loss of carbohydrates. A critical balance is supposed to exist between the temperature responses of photosynthesis and respiration. For the promotion of this work it is necessary that respiration and photosynthesis be measured, and that the light factor should be made reproducible as to both quality and intensity.

Climatic effects in the metabolism of maize, W. E. Tottingham and H. W. Kerr (*Plant Physiol., 1 (1926), No. 4, pp. 415, 416*).—These notes relate to preliminary results obtained with maize by use of methods similar to those previously used with sugar beet (E. S. R., 55, p. 520), the maize plant having been shown previously (E. S. R., 50, p. 628) to be comparatively independent of climatic influences as regards composition of the grain.

While sufficient grounds were not obtained for imputing to the differences in composition which are found the chief cause of stability of corn and sorghum against climatic influences, it is thought that "it may be ultimately important to consider that sucrose and less soluble forms of protein are quite likely to be less altered by the effects of temperature and other climatic factors than are such reactive compounds as glucose, soluble proteins, and other soluble nitrogenous compounds."

Some effects of the waxy gene in maize on fat metabolism, F. A. Abegg (*Jour. Agr. Research [U. S.], 38 (1929), No. 3, pp. 183–193*).—The results are given of studies which are said to show that the waxy gene produces marked effects on the fat metabolism, and that these effects are evident only in the endosperm tissue. The relationship between the effects of this gene on both carbohydrate and fat metabolism is unknown.

The author advances the hypothesis that the activities of the waxy gene are connected with the synthetic and hydrolytic powers of maize endosperm lipase.

Symbiotic fungi of cereal seeds and their relation to cereal proteins, S. L. Jodidi and J. Peklo (*Jour. Agr. Research [U. S.], 38 (1929), No. 2, pp. 69–91*).—It is claimed that fungi identified as smuts have been isolated from English ryegrass, wheat, and barley, which produce the aleurone layer and later penetrate also the peripheral cells of the endosperm, leaving there the proteins present in their tissues.

Biochemical studies have shown that English ryegrass seed contains an alcohol-soluble protein, prolamine. The symbiotic fungi of English ryegrass, wheat, and barley contain the proteins known to occur in the seeds of their hosts, and the fungi also contain prolamine, an essential component of gluten. The nonprotein nitrogen contained in English ryegrass and in the symbiotic fungi was found to be made up, in part, of protein degradation products, such as acid amides and amino acids.

Nitrogen metabolism of conifers [trans. title], K. Mothes (*Ber. Deut. Bot. Gesell., 45 (1927), No. 7, pp. 472–480, figs. 5*).—It is stated that most available accounts of nitrogen metabolism in higher plants relate to the early phases of nitrogen assimilation, particularly the uptake and distribution of inorganic nitrogen and the mobilization and movement of nitrogen-containing reserve materials. Knowledge regarding the synthesis of albumin and amino acids is

very scant, and their significance for the plant organism is obscure in comparison with what is known in this connection regarding animal organisms. A brief review, largely bibliographical, is given, and curves resulting from studies are shown. Conifers are typical amide plants, showing behavior analogous to that in legumes and cereals.

Sulphur metabolism of yeast, H. SUGATA and F. C. KOCH (*Plant Physiol., 1 (1926), No. 4, pp. 337–347*).—From this investigation, intended to determine as nearly as possible the forms of sulfur available for yeast growth and to investigate the changes which cystine undergoes in yeast growth and metabolism, it was concluded that magnesium and sulfur appear equally important in that relation. Of the forms of sulfur used, the inorganic sulfate was the most available. This is claimed to be a true nutrient, and to be converted into yeast protein and, probably at least in part, into cystine. Cystine, cysteine, and hydrogen sulfide stimulate yeast growth in a sulfate-free medium up to certain low concentrations, but above this level they retard growth. Cystine stimulates slightly in a sulfate-containing medium, but hydrogen sulfide retards growth even at low concentration. Yeast growing in a sulfate-free medium containing cystine as a sulfur source converts part of the cystine into new yeast protoplasm and about an equal amount into sulfate residue. Taurocholic acid in very low concentrations retards yeast growth. Cysteinic acid appears intermediate between taurocholic acid and cystine. Taurine in the concentrations here used had no action on yeast growth.

Plant growth-promoting substances, hydrogen ion concentration, and the reproduction of Lemna, N. A. CLARK (*Plant Physiol., 1 (1926), No. 3, pp. 273–279, fig. 1*).—Following up his previous work, some of which has been noted (E. S. R., 51, p. 609; 52, p. 28), the author found that for *L. major* (which grows and reproduces indefinitely in purified inorganic salt solutions without the addition of organic matter, in daylight or under electric light) the optimum pH for the nutritive inorganic solution ranged from 4.7 to 4.8. Indications suggest that this optimum varies with the composition of the solution, since a soil solution can grow good plants at a pH which produces poor and backward plants in the inorganic solution used. Frequent changes of the solution, which lessen the bacterial growth, increase reproduction in the Lemna plants. This is supposed to show, not that bacterial products are unfavorable to growth, but that other influences are usually predominant. Good growth was obtained by boiling the solution and changing the plants frequently to lower the bacterial contamination.

Evidence on the indispensable nature of zinc and boron for higher green plants, A. L. SOMMER and C. B. LIPMAN (*Plant Physiol., 1 (1926), No. 3, pp. 231–249, figs. 13*).—In experimentation constituting a portion of a more extensive investigation, photographic evidence was obtained, and is presented with discussion in this paper. This evidence is claimed as adequate to prove conclusively that boron and zinc are not simply stimulatory in plant life and growth but essential thereto throughout a wide range of higher plants.

The experimental technique which is necessary to such a demonstration is detailed, and this is claimed to be the crux of the problem. A general discussion is given of a few modern contributions on the general subject of chemical elements essential for plants in the light of a critical examination of earlier views and experiments.

Food storage, F. M. ANDREWS (*Plant Physiol., 1 (1926), No. 3, pp. 287, 288*).—Details are given regarding the application of centrifugal force to cells containing storage material (the amount and the compactness of which differ considerably), typically starch in seeds, until displacement was produced. This

required, in cases cited, intensities ranging as high as 6,000 gravities and in some cases soaking for a time as long as 24 hours or more. Oil content and temperature also entered as factors. No separation of the protoplasmic membranes from the cell walls occurred, nor were the cells killed by the long-continued action of the strong centrifugal force.

The capillary structure of softwoods, A. J. Stamm (*Jour. Agr. Research [U. S.], 38 (1929), No. 1, pp. 23–67, figs. 10*).—A report is given of dynamic physical studies of the structure of softwoods, such as are represented by the Sitka spruce, Alaska cedar, western red cedar, western hemlock, Douglas fir, and western yellow pine. The method as developed is said to extend the possibility of studying structures beyond the limits of microscopical visibility and to give data of a statistical nature, such as is impossible with the microscope. The present paper is devoted mainly to a discussion of the development of the methods of the investigation.

Pollen-tube behavior with reference to sterility in Datura, J. T. Buchholz and A. F. Blakeslee (*Mem. Hort. Soc. New York, 3 (1927), pp. 245–260, pls. 3, figs. 6*).—The purpose of the present study, in which reference is made to related reports by these authors (E. S. R., 47, p. 221; 57, p. 121), and by East and Park (E. S. R., 41, p. 430), was to test the effects, as manifested in pollen tube growth, of an attempted cross among species which had never been successfully crossed, in order to ascertain whether the incompatibility here apparent is due to a slowness of pollen tube growth or to other causes; also to collect information as to any definite abnormal phenomena, which might become obvious, in the pollen tubes themselves. The data, as shown in tabular and in graphical form, are discussed, and an outline, with discussion, is given of the technique, experimental methods, normal pollen tube growth, and interspecific crosses and pollen tube growth in these cases.

A conductivity cell for continuous measurements of respiratory rate, R. B. Harvey and L. O. Regeimbal (*Plant Physiol., 1 (1926), No. 2, pp. 205, 206, fig. 1*).—The apparatus here figured and described is stated to have some advantage over former types since it can be made small and compact and is not easily breakable. It is claimed to be very useful for measuring quick changes in the respiration rate of tissues as affected by treatment with ethylene or other gases.

Plant material introduced by the Office of Foreign Plant Introduction, Bureau of Plant Industry, April 1 to June 30, 1926 (*U. S. Dept. Agr., Inventory 87 (1929), pp. 54*).—Descriptive notes are given of more than 1,100 lots of seeds and plants secured for testing in the United States.

GENETICS

The number of chromosomes in the iris [trans. title], M. Simonet (*Bul. Mens. Soc. Natl. Hort. France, 5. ser., 2 (1929), Feb., pp. 88–94*).—Investigations conducted in the Laboratory of Botany of Vilmorin-Andrieux & Co., Paris, upon the chromosome constitution of a large number of species and forms of iris showed considerable variability. However, 12 was frequently the haploid or basic number, especially in the Pogoniris section where most of the common horticultural varieties are located.

Cromosome counts in Vitis and Pyrus, B. R. Nebel (*Amer. Nat., 63 (1929), No. 685, pp. 188, 189*).—Cytological investigations showed a prevailing count of 38 diploid chromosomes in the root tips of Vitis species and varieties and 34 in the pollen mother cells and ovarian tissue of Pyrus species and varieties. A considerable number of well-known American grapes and apples are included in the study.

Inheritance of kernel arrangement in sweet corn, W. A. HUELSEN and M. C. GILLIS (*Illinois Sta. Bul. 320 (1929), pp. 299–336, figs. 9*).—Studies of the first three filial generations from crosses between Narrow Grain Evergreen and the Country Gentleman, sweet corn varieties characterized by wide differences in the arrangement of kernels on the ear, indicated that the straight row arrangement is incompletely dominant over the zigzag plan. Dihybrid segregation into eight classes in the F_2 generation is believed to establish the presence of two factors controlling rowing, a hypothesis further supported by monohybrid segregation in the F_3 and F_4 generations, of which no single progeny included both distinctly rowed and zigzag types. Observations on selfed strains of each type and upon hybrids between the types suggested that the rowed arrangement of kernels is associated with greater vegetative growth and larger gross yields than is the zigzag arrangement. The authors believe that the double recessive zigzag kernel arrangement may be associated with one or more plant characters which segregate in a like manner.

Yellow-kerneled fatuoid oats, T. R. STANTON and F. A. COFFMAN (*Jour. Heredity, 20 (1929), No. 2, pp. 66–70, figs. 2*).—Yellow-seeded fatuoids were observed under a wide range of environmental conditions in the Richland and Iogold oats strains, both yellow-kerneled, pure line selections from Kherson. All the fatuoids classed as homozygous when collected bred true for yellow.

A serological ranking of some wheat hybrids as an aid in selecting for certain genetic characters, C. I. NELSON and J. M. BIRKELAND (*Jour. Agr. Research [U. S.], 38 (1929), No. 3, pp. 169–181, figs. 5*).—The serological method was applied at the North Dakota Station in an attempt to determine the relationships existing between the wheats Mindum (durum) and Marquis (Hard Red Calcutta×Red Fife), Hard Federation (selected from Federation [Purplestraw × Yandilla]), 1656–81 (Kota × Marquis), and Hope (Yaroslav emmer × Marquis).

The results showed that globulin-like protein fractions could be extracted from wheats by appropriate mechanical and physical methods, the globulins being pure enough to lend themselves to the serological differentiation of closely related hybrid wheats. Wheat varieties having the most genetic factors in common showed the closest relationships serologically, e. g., a close serological relationship was noted between Hope, 1656–81, and the common parent, Marquis. In cross titration with the various heterologous antisera the antigens assumed a definite linear relationship. In the linear relationship established by the heterologous antigens in titration with Mindum antiserum the order was Hope, 1656–81, Marquis, and Hard Federation.

The serological ranking is paralleled to a certain extent by the genetic characters for which the wheats were selected originally. It is suggested that within limits the use of the specific globulin fractions involved in the serological technique may serve the plant breeder as serological indicators of special characters which are coincident with the inheritance of the specific protein make-up of the variety. The extreme complexity of the protein structure within which the genetic complex of the variety is involved was indicated by a series of absorption tests.

Cross breeding experiments (*South Dakota Sta. Rpt. 1928, p. 14*).—Heifers produced by crossing Holsteins and Jerseys which have thus far freshened are smaller and more refined than purebred Holsteins, but not as refined as purebred Jerseys. All F_1s are black and white, except one, which is a brownish black. The second generation Jersey back-crosses are also black and white in color.

FIELD CROPS

[Agronomic work in Oregon] (*Oregon Sta. Bien. Rpt. 1927–28, pp. 62–69 72, 115, 116, 117, 121, 122*).—Leaders in varietal trials (E. S. R., 60, p. 731) have included White Winter and Queen Wilhelmina (true winter varieties) and Jenkin and Rink (spring varieties) for winter wheat, and Huston, Marquis, and Zimmerman for spring wheat; Victory spring oats and Gray Winter fall oats; OAC No. 7 and Hannchen barley; Saginaw fiber flax; Damont and Linota seed flax; Minnesota 13 and McKay Yellow Dent corn; variegated alfalfas, especially Grimm; Chilean and local Oregon strains of red clover for forage; Tennessee anthracnose-resistant red clover for seed; and New Zealand White Belgian carrots. Outstanding forage grasses included English ryegrass, rust-resistant timothy, meadow foxtail, Kentucky bluegrass, orchard grass, tall oatgrass, and redtop. Other activities noted briefly included breeding work with wheat, oats, barley, fiber flax, and potatoes; trials of miscellaneous forage legumes, grasses, and root crops; seeding tests with wheat; a manuring test with alfalfa; a fertilizer trial with potatoes; and rotation and manurial trials.

For wheat, land plowed before fall rain produced slightly less than land plowed afterward, and disking before fall plowing affected yield little. An 8-in. depth yielded more than 5-in. plowing, but little was gained over 8-in. by plowing 11 in. deep for fall grain. Disking before spring plowing for spring grain enhanced the yields of late-plowed plats; with such disking the lowest yields came from the shallowest plowing. On late plowing depth made little difference. Early-plowed plats produced more than late-plowed plats. Winter wheat more than doubled the yield of spring wheat on adjacent plats.

Land plaster in the hill with the seed has improved corn yields substantially, particularly as to forage, and has been better than commercial organic mercury dusts, whereas readily soluble fertilizers in the hills with the seed have injured the stand.

Fiber flax drilled gave higher yields and longer fiber than when broadcasted, and on firm rather than loose seed beds. A 95-lb. seeding rate proved better than the usual 110 to 115 lb. rate, and early planting significantly surpassed later planting. Early drilling on a firm seed bed gave the best results with seed flax.

Potato investigations continued to show that the blossom-end method of cutting was superior, and that early planting, about 5-in. deep, of blocky sets coated with land plaster is most satisfactory for commercial production. Cut tubers exposed to strong sunlight just after cutting were damaged from 50 to 60 per cent, as indicated by stand and yield.

Field studies indicated that pasture establishment to be economical should be done on a good "first burn." Good stands may be had easily by fall seeding on a good burn. For permanency and to resist encroachment from brush, the pasture mixture must include sod formers, and the land must be kept grazed. Permanent legumes seemed important considering productiveness, fertility, and feed quality. Many loggings were irreparably damaged by losing the long-time effects of a first burn as a result of seeding cheap and temporary burn mixtures. Rotation grazing which permits close pasturing appeared to be desirable. It was observed that unseeded, burned-over land or land seeded to temporary burn mixtures soon returned to brush.

Weed-control studies showed that carbon disulfide under optimum conditions is a good herbicide but as ordinarily applied is too expensive and not generally successful. Sodium chlorate at the rate of 1 lb. per gallon of water killed quack grass in a single application and was quite effective on Russian knap-

weed, wild morning-glory, and Canada thistle. Sodium arsenite also has given fairly good results on these three weeds last named.

The merits of hairy vetch, Monantha vetch, Hungarian vetch, soybean, zigzag clover, and sweetclover are commented on as heretofore. Austrian Winter field peas did best on a well-prepared seed bed, but were not well suited to stubbling in. They are about as susceptible to aphids as common vetch and are attacked by pea weevil, which necessitates prompt threshing and immediate fumigation thereafter to market the crop in good condition.

With red clover, seeding in the late winter on fall grain was the most economical method. Sowing alone on a well-prepared seed bed later in the spring was recommended for stands where lands are weedy or on run-down lands where stands are difficult to obtain. Strawberry clover appeared to be an excellent alkali pasture clover and to have turf-forming possibilities on alkaline soils that may be kept well watered.

Seeding tests with alfalfa demonstrated that good stands may be had from small quantities of seed. Favorable conditions for growth, such as a good seed bed, successful inoculation, and good moisture and nutrient conditions, were more effective in obtaining good stands than were small variations in the seeding rate. Barnyard manure, together with freedom from weeds, gave promising results at the Umatilla Substation in the reestablishment of alfalfa declining in yield because of winterkilling, weeds, and continuous cropping The more mature alfalfa became before cutting the higher was the yield obtained during the year. The quality of hay cut beyond rather full blossom, however, was questioned. Border irrigation with large heads of water proved to be most economical for the irrigation of light, sandy soils growing alfalfa. Early seeding in late February or early March and rolling to obtain a firm, hard seed bed sufficed to give satisfactory stands of sweetclover for pasture.

According to duty of water experiments at the Harney Valley Substation, reasonably correct quantities of water for profitable crops are, for cereals from 12 to 14 acre-in., alfalfa 18, clovers and field peas 15 to 18, Mammoth Russian sunflowers 30, and potatoes 10 to 14 acre-in. Results under adverse conditions suggested that crops could be profitably produced with pumped water in the valley (E. S. R., 60, p. 132). The leading varieties of field crops are indicated for both dry land and irrigation.

[**Agronomic investigations in Utah**], A. F. BRACKEN, G. STEWART, D. W. PITTMAN, A. L. WILSON, J. W. CARLSON, D. C. TINGEY, and R. J. BECRAFT (*Utah Sta. Bul. 209 (1929), pp. 20–22, 23–35, 77*).—Continued experiments (E. S. R., 56, p. 525) reported on from the station and substations included variety tests with winter and spring wheat, oats, corn, barley, rye, and alfalfa; breeding work with wheat, potatoes, and alfalfa; cultural (including planting) tests with wheat, sugar beets, and Jerusalem-artichokes; irrigation tests with alfalfa, wheat, corn, potatoes, sugar beets, and peas; manure, green manure, and stubble disposal tests with wheat; trials of forage, root crops, and catch crops; crop rotations; and range reseeding tests.

Cultural tests, presumably with wheat, at the Nephi Substation showed that with normal tillage after plowing, fall plowing gave higher yields than spring plowing, whereas without subsequent tillage the advantage was reversed. The 8 and 10 in. depths surpassed shallower and deeper plowings. Frequent tillage of fallow from either fall or spring plowing did not result in yields higher than from normal tillage consisting of about two harrowings and leveling. The highest acre yield in cropping experiments, 18 to 20 bu., came from the plat fallowed two years before the crop. Alternately cropped plats yielded between 15 and 16 bu., and continuous cropping produced between 3 and 5 bu. per acre.

Time of plowing, an important factor on the dry lands in the conservation of moisture, was found to be directly related to the nitrate accumulation. High nitrate content in the soil also influenced the protein content of wheat.

Irrigation tests at Greenville Farm to date showed an average maximum yield of sugar beets to result from about 30 in. of irrigation water, of potatoes about 20 in., and of alfalfa from heavy irrigation. More than 30 in. of irrigation water usually reduces the yields of all crops except alfalfa, although the water table is 100 ft. from the surface on the farm. The results as a whole are consistent with those of the previous 10 years, in so far as the treatments are duplicated.

A maximum corn yield followed application of about 20 in. of irrigation water and a lower yield from either more or less water. The corn making this maximum yield received 15 tons of manure per acre. Manure somewhat lessened the loss due to under or over irrigation, and optimum irrigation appeared especially important where manure was lacking. The surface soil with the higher irrigations showed very consistently a lower nitrate content. Manure increased the soil nitrate.

A low moisture content in the soil during the period from when the wheat plants first started to joint until spike exsertion commenced caused the most serious reduction in yield. About 20 per cent of moisture seemed to be the optimum for sugar beets on the particular soil.

According to rotation and fertility tests, manure is essential for the best production of all crops on the soil and especially for sugar beets, alfalfa, potatoes, and corn. Some sort of rotation is quite essential for the small grains, but with sugar beets only certain rotations are successful, and continuous cropping with adequate manure returns satisfactory results for at least 10 years, so long as nematode and other pests are avoided. Both sugar beets and wheat yielded better after sugar beets than after grain, and sugar beet yields were intermediate after potatoes and peas. For sugar beets a good rotation evidently would have beets succeed themselves for 2 or 3 years, provided the soil was free from nematodes. Green manures were of little or no value compared with barnyard manure. A long rotation embracing alfalfa and manure seemed to be the most satisfactory to date. Unmanured rotations including peas and beans have not maintained soil fertility.

The late blight or root rot of sugar beets appeared to be largely influenced by the cultural method. Manure greatly increased the resistance of the beets to root rot, whereas beets in rotation seemed to be more susceptible to the disease than those after sugar beets. A close relation was observed between the nitrate content of the surface soil in spring and early summer and sugar beet yields. Later in the summer manured plats on which beets grew vigorously were reduced in nitrate content to below the unmanured plats. In order of their nitrate content soils planted to different crops ranked in the following order: Potatoes, sugar beets, corn, peas, small grains, and alfalfa.

In genetic studies with wheat (E. S. R., 59, pp. 127, 622, 821), a rust-resistant progeny was obtained from Federation × Sevier, both parents being susceptible to black stem rust. Awn inheritance in Sevier×Federation wheat was found to be controlled by two linked factors. Strong correlations were found between length of spike and length of awn in Kanred × Sevier. Some progenies also had more compact heads than either parent, a striking recombination of genetic factors. Two awnless wheats, Marquis and Federation, when crossed produced true breeding, awned progenies in about 25 per cent of the strains tested. A cross between Federation and a different pure line of Sevier exhibited a two-factor difference for awns with the factors independent in behavior. The more compact heads were again more frequent.

With the Mammoth French White Jerusalem-artichoke no appreciable difference was observed between fall and early spring planting or between early winter and spring harvesting. Small sets returned fewer and larger stalks per hill than did large whole tubers, but the tuber yield was not noticeably different. The acre yield of tubers where the tops were cut for silage was 7.6 tons and where the tops were not cut 11.4 tons. Tubers stored in small piles on the soil surface with a little soil sprinkled over them kept better over winter than tubers carefully pitted and protected by a considerable cover of straw and soil.

Either no clipping or clipping not later than the beginning of blooming was found most favorable for production of alfalfa seed at the Uintah Basin Alfalfa Seed Experimental Farm. Cultivation tests demonstrated that cultivation is for weed control and results in a higher purity test of the seed produced. So far the type of cultivation has not influenced the seed yield greatly. Under the experimental conditions the best seed yield came from plats receiving no irrigation. Application of from 4 to 5 in. of water during the previous fall or very early in the spring before the alfalfa had grown much somewhat reduced the seed yield. The seasonal behavior of alfalfa flowers as related to seed production has been reported on (E. S. R., 59, p. 826).

[Agronomic investigations of the Agricultural Research Institute, Pusa, 1927–28], F. J. F. Shaw, W. H. Harrison, T. S. Venkatraman, and N. L. Dutt (*Agr. Research Inst., Pusa, Sci. Rpts. 1927–28, pp. 9–29, 31, 32, 33, 34, 132–143, pl. 1*).—Research activities with different field crops described as heretofore (E. S. R., 59, p. 223) included breeding work and inheritance studies with wheat, oats, corn, barley, tobacco, flax, *Cajanus indicus*, sesamum, safflower, grain, peas, sugarcane, and hemp; studies of the effect of fertilizer constituents on the quality of sugarcane juice and crude sugar; curing experiments with tobacco; and breeding technique, root studies, observations on flowering habit, pollen, and seed germination, and hybridization work, all with sugarcane.

[Agronomic studies in Wales] (*Welsh Jour. Agr., 4 (1928), pp. 157–170, 222–254, 269–280, pls. 2, figs. 2*).—In addition to the papers abstracted below, this number includes the following articles of agronomic interest: The Significance of Variety in Oats with Respect to Yield and Other Ancillary Characters under North Wales Conditions, by R. A. Roberts (pp. 157–170); An Investigation into the Soil Germination and Yield of Certain Crucifers, Clovers, Italian Rye-Grass, and Chicory Sown at Three-Weekly Intervals from May to November, 1925, by W. E. J. Milton (pp. 222–242); Sainfoin or French Grass in South Wales, by J. Rees (pp. 242–250); The Influence of Seed Rate on the Establishment of Perennial Rye-Grass, Timothy, and Rough Stalked Meadow Grass, by W. Davies (pp. 250–254); and Field Trials with Welsh Seed Potatoes, by T. Whitehead and O. R. Morris (pp. 269–280).

Grain crops in western Washington, M. E. McCollam (*Western Washington Sta. Bul. 11–W (1929), pp. 19, figs. 5*).—Oats, followed by wheat, is the cereal grown most extensively in western Washington, while relatively limited acreages are devoted to rye and barley. Abundance and Sparrowbill oats led in trials on upland shot clay soil, and Maine No. 340 and Markton oats did best in later tests on sandy bottom land. Other noteworthy cereal varieties included Brown Squarehead, Wilhelmina, and Triplet wheat, Rosen rye, and White Winter and Hannchen barley. Cultural methods and field practices are outlined briefly.

The behaviour of grasses in the seeding year when sown in pure plots: Establishment, rate of growth, and palatability, W. Davies and M. T. Thomas (*Welsh Jour. Agr., 4 (1928), pp. 206–221, figs. 2*).—Observations at the Welsh Plant Breeding Station, Aberystwyth, on 16 native and exotic species

demonstrated that under normal sward conditions in the field wide differences exist in the agronomic behavior of the species in the year of seeding, such as in relative establishment, rate of early development, tiller production, palatability, and winter greenness. Italian ryegrass showed outstanding potentialities during the early growth periods.

Factors that influence the chemical composition of hay, T. W. Fagan (*Welsh Jour. Agr., 4 (1928), pp. 92–102*).—The best time to cut hay, according to results of experiments by the University College of Wales, Aberystwyth, is a few days after it has reached the stage of maximum flowering and before seed formation begins. Further delay causes deterioration in quality. The chief effect of the inclusion of clover is to increase the protein and mineral content, especially lime, of hay. The more leafy hay is of the better quality. Nitrogenous fertilizers increase the protein and decrease the fiber content. Phosphatic fertilizers, aside from any resultant increase in clover, affect the mineral content of the hay, whereas potassium fertilizers, in the area considered, seem without any significant effect, probably because the soils generally have adequate potassium. Farmyard manure and liquid manure similarly increase the protein and decrease the fiber content of hay, and, in addition, liquid manure increases the silica-free ash, lime, chlorine, and potassium. Hay harvested under unfavorable weather conditions is poorer than that under good conditions, due to leaching of soluble ingredients, and also has a high fiber content.

The composition of old pastures of high reputation in north Wales, R. A. Roberts (*Welsh Jour. Agr., 4 (1928), pp. 170–183*).—Eleven pastures of varying grazing performances in the counties of Carnarvon, Anglesey, and Denbigh were analyzed botanically on the basis of the percentage dry weight of the different species. They were all characterized by early growth in spring and a steady, even performance until well into June, this being favored by their situation on deep, well-drained soils with favorable aspects and high water tables. Ecologically they are transitional, embracing a slight heath element, and they have been so maintained indefinitely by judicious management. While they are never grazed very closely in the growing season, they are not allowed to grow rank and coarse. All contain a high proportion of perennial ryegrass and wild white clover, with varying quantities of other good species and also high proportions of Yorkshire fog or bentgrass or both.

Leaf temperatures of cotton and their relation to transpiration, varietal differences, and yields, F. M. Eaton and G. O. Belden (*U. S. Dept. Agr., Tech. Bul. 91 (1929), pp. 40, figs. 10*).—Comparisons between the leaf temperatures of Pima Egyptian and Acala upland cottons were made during 1926 at Sacaton, Ariz. The leaf temperature measurements were made by the thermoelectric method, in terms of the departures of the leaf temperatures from the temperature of the air.

Leaves of similar exposure and age were found to vary in temperature, the variations being in general greatest during the hours of maximum transpiration and of greatest intensity of climatic factors. Cotton leaves nearly normal to the sun and leaves at an angle approaching 90° from normal differed by an average of 2° C. Young leaves were cooler than old leaves. A maximum mean difference of 5.5° was observed in the temperature of wilted and turgid Acala leaves. A correlation coefficient of -0.929 ± 0.025 was estimated between the differences in the leaf temperatures and the differences in the transpiration rates of turgid and wilted Acala plants. Approximately 40 per cent of the energy required for the transpiration of cotton plants in midafternoon was found to be derived from radiations intercepted by the leaf.

Turgid Pima leaves were lower in temperature at each hour of the day before sunset than were turgid Acala leaves, the greatest differences occurring in the

hours of highest transpiration rates. No significant differences appeared in the hourly fluctuations in transpiration rates of Pima and Acala cotton when these were expressed as the hourly percentage of the days' total. Wilted Pima leaves were cooler than wilted Acala leaves when grown in the same cans, and turgid Pima leaves were cooler than turgid Acala leaves by an average of 2.44°. During the middle of the day when fully exposed to light Pima leaves had mean temperatures ranging from 2 to 5.3° below air temperature, while in the same respect Acala leaves varied from +0.2 to −2.5°. The leaves of okra-leaf Acala were cooler than Acala leaves in five of six comparisons by 1.02°. With Acala cotton, leaves of plants grown beneath a muslin shade were cooler than the leaves of freely exposed plants by 1.92°; leaves of whitewashed plants were cooler than leaves of untreated cotton by 3.06°; and leaves of plants growing in a saline soil were warmer than leaves of cotton in a control soil by 0.83°.

It appeared probable that the relatively low yields of Acala cotton at Sacaton in years having an average summer temperature above 100° F. and the considerably greater yields in cooler years, in contrast with the lower fluctuations in Pima cotton yields, which fluctuations showed no relationship to the mean maximum summer temperatures, are associated with differences found in leaf temperatures of the two varieties.

The correlation between the soil salinity and flowering date in cotton, J. A. Harris (*Jour. Agr. Research* [*U. S.*], *38* (*1929*), *No. 2, pp. 109–112*).—*Studies in cultures of Pima Egyptian and Meade and Acala (upland) cottons* at Sacaton, Ariz., gave indications that a low negative correlation exists between the soil resistance and the time required for flowering in the three varieties, i. e., the flowering date is slightly retarded by soil salinity.

Cotton variety tests, 1928, T. S. Buie (*South Carolina Sta. Circ. 35* (*1929*), *pp. 11, fig. 1*).—The Cook 1010, King, Trice, Piedmont Cleveland, and Coker Cleveland 5 varieties produced the highest yields of seed cotton during the period 1924–1928 at the station. However, the staple of Cook 1010 and King was not satisfactory in length. At the Pee Dee Substation at Florence, Dixie Triumph closely followed by three Cleveland strains produced the highest average yield from 1925 to 1927. Of the long-staple varieties, Carolina Foster, Lightning Express, and Deltatype Webber were simliar in average yield. Dixie Triumph, Dixie 14, and Super Seven led in 1926 and 1927 on land badly infected with wilt. Coker Cleveland 5 made the highest average yield during 5 years at the Coast Substation and was followed by Woolsey Cleveland, College No. 1, and Dixie Triumph in order. In the test in 1928 at the Sand Hill Substation near Columbia four of the seven leaders were Cleveland strains, each producing a staple longer than ⅞ in.

Results in all tests showed that the best strains of Cleveland led in the production of seed cotton, and they are recommended for general planting on wilt-free land.

Recent fertilizer experiments with cotton, H. M. Steece (*U. S. Dept. Agr., Off. Expt. Stas., Rpt. Agr. Expt. Stas., 1927, pp. 79–86*).—Investigations by the southern experiment stations with fertilizers for cotton reported during the years 1919–1927, inclusive, are reviewed. Fertilizer mixtures, arranged from the results of experiments, are noted, together with accounts of the relative merits of different sources of the nutrient elements, methods of application, and related practices. The review is limited to results and recommendations, although technic is discussed briefly in conclusion.

The relationship of origin to hardiness in red clover, G. P. McRostie (*Canada Expt. Farms, Div. Forage Plants Rpt. 1927, pp. 24–31, figs. 4*).—Extensive trials at Ottawa of red clover from many sources showed Canadian-grown

seed to be much superior to other strains. A number of lots from Great Britain seemed suitable for Canadian conditions, whereas no Italian and few French lots showed much winter hardiness. Hairiness of stems and leaves appears to characterize typical Canadian-grown red clover.

Classification of Canadian grown varieties of field corn, G. P. McRostie (*Canada Expt. Farms, Div. Forage Plants Rpt. 1927, pp. 5, 6*).—Dent, flint, sweet, and flour corns, representative of the different varieties of field corn commonly grown in Canada, are grouped according to maturity, and their several agronomic characteristics are tabulated in considerable detail from studies during several years at the Harrow, Ont., Experimental Station.

The Jerusalem artichoke, H. A. Schoth (*Oregon Sta. Circ. 89 (1929), pp. 16 figs. 5*).—The Jerusalem-artichoke (*Helianthus tuberosus*) and its varieties and adaptation are described, with information on cultural and field methods and harvesting and storage practices. The merits of the crop for food, feed, and forage are discussed, and production costs, diseases and pests, and improvement are treated briefly. Investigations supporting many of the recommendations were in cooperation with the U. S. Department of Agriculture.

Kafirs as forage sorghums, H. H. Finnell (*[Oklahoma] Panhandle Sta., Panhandle Bul. 3 (1929), pp. 9–11*).—Varietal comparisons during the period 1924–1928 showed that kafirs could replace forage sorghums (sorgos) without reduction in yield of total digestible nutrients. Kafirs cure in the shock more quickly than some of the more juicy varieties, permitting the roughage to be stacked sooner, with less weathering as a consequence. The narrower nutritive ratio of the kafirs is held to be an advantage in the Panhandle region where protein feeds are relatively scarce.

The chemical composition of mangolds grown in mid Wales, T. W. Fagan and J. E. Watkin (*Welsh Jour. Agr., 4 (1928), pp. 102–113*).—Time of seeding at the University College of Wales, Aberystwyth, affected the contents of dry matter and of sugar in mangels, early (April 10) seedings generally having lower percentages of both than late (April 30) seedings. Nitrogenous fertilizers as their chief effect increased the percentage of protein in the dry matter. Potassium appeared to narrow the ratio of true crude protein, suggesting that it causes the roots to mature earlier than those receiving no potassium. Storage until spring resulted in lowered contents of dry matter and sugar, but the percentage of true protein in the dry matter greatly increased. The dry matter was also richer in silica-free ash, and with the exception of silica and chlorine, in most of the mineral constituents determined. "Bolting" reduced the dry matter and sugar content of the mangel.

The normal multiple sprouting of seed potatoes, J. Bushnell (*Ohio Sta. Bul. 430 (1929), pp. 27, figs. 10*).—The sprouting habit (E. S. R., 59, p. 223) of sets of the Russet Rural potato variety was studied in successive plantings in the greenhouse and in the field. The results demonstrated that the rest period extended to December or early January, that single sprouts were produced until March or early April, and that in succeeding plantings a progressive increase took place in the number of sprouts. From seed tubers stored near 4° C. (39.2° F.), cut into pieces weighing 56 gm., and planted in the field an average of two sprouts per piece came forth in plantings about May 1, three sprouts in plantings about June 1, and four sprouts per piece from plantings about July 1.

Mature tubers put forth more sprouts than immature tubers when the difference in maturity was due to the time of planting the preceding season. Tubers stored at about 4° produced more sprouts than those stored near 0. Ventilation and exposure to light appeared to be relatively minor factors. Tubers

from ordinary dark, cool storage did not differ significantly in sprouting habit from those exposed to light in a warm place for some time before planting. Tubers that produced long sprouts in warm, dark storage and were desprouted before planting bore more sprouts than tubers exposed to light before planting. Wilted tubers gave more sprouts than unwilted tubers. The effect of the weight of the set varied directly with the stage of multiple sprouting of the tubers.

There were no significant differences in the sprouting habit which could be attributed to the temperature of the soil in which the seed was planted or to differences in the time of harvest from plantings made at the same time. Thiourea treatment of sets planted in January resulted in typical multiple sprouting such as is normal several months later.

Elite potato seed produced to avoid disease, J. E. KOTILA and G. H. COONS (*Michigan Sta. Quart. Bul., 11 (1929), No. 3, pp. 133–137, fig. 1*).—A preliminary report of the development of strains of potatoes from single tubers, through selecting by the tuber index method and following with four years of isolation and close inspection before releasing to farmers, is presented, with comments on the production of foundation stocks. A detailed technical account of the experimental work on the clonal lines of potatoes referred to is in preparation.

Respiration of sorghum grains, D. A. COLEMAN, B. E. ROTHGEB, and H. C. FELLOWS (*U. S. Dept. Agr., Tech. Bul. 100 (1928), pp. 16, figs. 3*).—Experiments to determine the relationship between factors entering into the keeping qualities of the grain sorghum, made under controlled conditions, showed that the hygroscopic moisture of sorghum grain when in equilibrium, at from 25 to 28° C., with atmospheres of different relative humidities, was similar to that of the other cereal grains. At relative humidities of 75 or greater, however, the other cereal grains contained more moisture. The relationship between hygroscopic moisture and relative humidity was very similar in all the sorghum classes studied. The average hygroscopic moisture of the nine classes of sorghum grains observed ranged from 6.65 per cent at 13.8 per cent relative humidity to 28.04 per cent at 100 per cent relative humidity (from 25 to 28°).

Acceleration of the respiratory rate with an increase in the moisture content was gradual, with no sharp break in the curve. If the moisture content is between 13 and 14 per cent, the acceleration is rapid and increases in intensity as the moisture content increases. In this respect the respiratory activity of the sorghum grain resembles that of rice. Cracked and broken sorghum kernels respired more vigorously at high moisture contents than normal whole kernels, indicating the increased risk involved in storing and transporting sorghum grains containing appreciable quantities of broken kernels. Furthermore, the greater storage difficulties of the sorghum grains, as compared with other cereals, seemed largely due to the high percentage of cracked kernels usually present in commercial lots. The length of time of excessive moisture in the grain was found directly related to the rate of heating. As the temperature rose from 27.8 to 37.8° yellow milo respired nearly twice as rapidly. Heat-damaged sorghums likewise respired more vigorously than did sound kernels.

Laboratory storage experiments involving 10 sorghums containing about 14, 16, 18, and 20 per cent of moisture held during 7 weeks at from 100 to 102° generally confirmed the observations in the respiration studies that if the temperature is high enough, 100° F. or more, sorghum grains containing over 14 per cent of moisture will go out of condition.

Test yields from commercial sugar beet seed, J. G. LILL (*Michigan Sta. Quart. Bul., 11 (1929), No. 3, pp. 120–124*).—The stand, acre yields of beets and

sugar, percentage of sugar, and purity are tabulated for beets grown near Saginaw, Mich., in 1928, from 50 brands of commercial sugar beet seed. The UDYCZ B, Mayzel-Granum Plenne, Bielotzerkov 10 E, Verchiatchka 3 N, Heine Original, and Uladovka 4 E strains appeared to lead in acre sugar production.

The influence of nitrogen fertilization on the sucrose content of sugar cane, W. P. ALEXANDER (*Planter and Sugar Manfr., 82 (1929), No. 9, pp. 161–163, fig. 1*).—The application of nitrogen beyond 150 lbs. per acre in experiments during two years at Ewa Plantation, Hawaii, was followed by a depression in sucrose content, greatest in the first additional 50 lbs. The depression was less from 200 to 250 lbs., but the benefit of increased cane tonnage was lost in the poorer quality ratio. Further increase seemed detrimental to the juice and without response in cane or sugar yield. The juice of cane grown on the pali and coral soil types was influenced less by nitrogen applications. If cane was harvested when it ripened normally, i. e., in May, the juices were better, irrespective of nitrogen treatment. Conversely, cane harvested in the early season suffered more from added nitrogen.

Approved practices for sweet potato growers, H. B. MANN, R. F. POOLE, and R. SCHMIDT (*North Carolina Sta. Bul. 263 (1929), pp. 6*).—Practices approved for the production of sweetpotatoes are outlined under the topics of varieties, seed stock, plants, plant bed, seed treatment, plant treatment, soil types, fertilizers, cultural methods, harvest, and storage.

Third annual wheat field-week, June 26, 27, 28, and 29 (*Ohio Sta. Circ. 7 (1928), pp. 4, fig. 1*).—This is a program of the papers and demonstrations presented at the Ohio Station, June 26–29, 1928.

A seed counter, E. BROWN, E. H. TOOLE, and W. L. GOSS (*U. S. Dept. Agr. Circ. 53 (1928), pp. 4, figs. 2*).—The seed counter, consisting essentially of a metal plate having 100 holes to which seed are drawn by vacuum, was developed in the U. S. D. A. Seed Laboratory and has been found to be an aid to accuracy and speed in testing seeds for germination. The device is not patented, and its manufacture or use is not restricted. Construction details are given.

Agricultural seed, A. S. LUTMAN (*Vermont Sta. Bul. 288 (1928), pp. 8*).—Noteworthy findings in the analysis for purity and germination are described for 599 samples of agricultural seed collected from dealers in Vermont during 1928.

Sodium chlorate spray controls quack grass, C. R. MEGEE and R. S. HUDSON (*Michigan Sta. Quart. Bul., 11 (1929), No. 3, pp. 129–132, figs. 2*).—Quack grass sprayed with sodium chlorate late in May and again about June 15 was controlled very effectively. Preliminary tests indicated that the first applications should be fairly heavy and followed by a lighter application when the quack grass had resumed growth. Good results were had from a first application of 100 to 150 gal. per acre of a solution of 1 lb. of sodium chlorate per gallon of water, and 100 gal. for the second application.

Part of a 15-acre field of quack grass was sprayed with sodium chlorate, and sheep remained in the field, apparently without injury. However, they had all of the common salt and mineral mixture desired, and an abundance of unsprayed pasture was available.

Another method giving very good satisfaction consists of carefully done, deep (9- or 10-in.) fall plowing followed by shallow (4- or 5-in.) spring plowing. After good plowing the seed bed is thoroughly and carefully fitted for corn or any other clean-cultivated crop. Oats seeded to alfalfa follows the corn and the alfalfa remains four or five years. In a method which combines spray treatments and cultivation a part of one field was sprayed with sodium chlorate

and then both the sprayed and unsprayed parts were plowed. The quack grass was far more vigorous on the unsprayed portion. Other control methods are discussed briefly, with cautions to be observed in handling sodium chlorate.

HORTICULTURE

[Horticultural investigations at the Oregon Station] (*Oregon Sta. Bien. Rpt. 1927–28, pp. 77, 78, 88–96*).—The customary biennial report (E. S. R., 60, p. 738).

The use of mineral oil emulsions with a high sulfur content or containing large amounts of unsaturated compounds was followed by excessive foliage injury. Determinations of the adhesive quality of commercial Bordeaux mixtures and of homemade Bordeaux on apple foliage showed the homemade to be superior in adhesion. The proprietary materials were improved by adding casein spreaders. Comparable tests on potato foliage gave no definite results.

Work in spray residue removal practically resolved itself into the use of dilute solutions of hydrochloric acid in concentrations of 0.25 to 0.75 per cent. The increased difficulty of removal due to the use of spreaders and inevitable dust and grit was offset by the addition of lime hydroxide or carbonate to the spray. Heavy and improperly timed applications of oil emulsion increased the difficulty of cleaning fruits. Harvesting promptly followed by immediate washing before waxlike secretions were deposited aided in reducing the difficulty from this source. Cherries and gooseberries were also successfully washed in acid. Fruit washers developed by the station proved successful in the Hood River district. Since not only arsenic but also lead, copper, and dust were removed in the acid bath, cleansing is proving a generally valuable process. A successful method of handling pears was developed for the Rogue River growers at Medford.

Attempts to propagate blueberries by cuttings were generally unsuccessful.

Studies in the harvesting and handling of various fruits, including the pear, cherry, prune, red raspberry, and apple, are briefly discussed. The maturity and quality of sweet cherries were accurately determined by the Balling scale for sugar, differences of from 10 to 12° being observed frequently between early and late picked fruit. The pressure test proved a valuable means of determining the maturity of Italian prunes. In the case of red raspberries improper handling in the field was, apparently, the principal cause of failure to stand up after picking. The sugar content of the juice proved of negative value as an index to raspberry maturity. Fertilizer, cultivation, and pruning were effective in restoring old run-down Italian prune orchards of the Willamette Valley to production.

Material differences were recorded in the self-pollinating capacities of tomato varieties in the greenhouse. Certain English kinds, such as Sutton Best of All, evidenced a high degree of self-fertility and were pollinated by simply jarring the clusters. Strain studies with beets and carrots showed a high degree of variability. Soil affected color in beets, the percentage of usable roots in three strains being from 5 to 13 per cent higher on silt loam than on sandy loam. In the summer of 1927 irrigation yielded large profits with sweet corn, cabbage, and squash.

Studies in the standardization of prunes showed a wide range in sugar and acid content in both fresh and dried fruit. Moisture determinations of fresh prunes showed drying ratios of from 4:1 to as low as 1.1:1 and suggested a ready means of judging proper maturity. Studies in heat penetration indicated that many processors are not equipped to give proper sterilization, espe-

cially when diseased fruits are present. More time should be spent in processing that the heat may reach the centers of the fruits.

Cherries selected for ripeness gave better color, flavor, and more uniform sirup cut-outs. Further, the cans in the ripe lots did not have the same tendency toward perforation as did those containing greener fruits. Cherries not fully ripe were light in color, showed considerable shrinkage in packing, and the cut-out of sirup was lower in sugars. Paraffining cans reduced the spoilage from hydrogen.

[Horticultural investigations at the Hood River, Oreg., Substation] (*Oregon Sta. Bien. Rpt. 1927–28, pp. 119–121, 122, 123*).—The usual biennial report (E. S. R., 60, p. 739). Observations in 1927 on the extent and nature of winter injury to fruit trees showed such leading varieties as Yellow Newtown, Esopus (Spitzenburg), Ortley, and Jonathan apples and Bosc, Bartlett, and Anjou pears to have been severely injured. Arkansas, McIntosh, Astrachan, Arkansas Black, and Delicious apples and Flemish and Easter Beurre pears were resistant. A large number of apple and pear varieties and species were tested for hardiness as rootstocks. As a means of controlling trunk injury from cold, shading on the sunny sides proved partly effective. Variety tests of apples, pears, strawberries, and other fruits are reported.

Orchard fertility investigations suggested the value of quick-acting nitrogenous fertilizers for the apple. On full-bearing Anjou trees growing on a high upper valley loam, commercial fertilizers, including sheep manure, gave no outstanding results. With strawberry plants twice a year applications of 500 lbs. of a 0–10–0 fertilizer gave notable increases in yield. The addition of potash gave no consistent response.

Anjou and Bosc pears picked at midseason kept better in cold storage than did early or late picked fruits. In the case of Delicious, Ortley, Esopus, and Yellow Newtown apples the results as a whole favored early picking. Change in ground color was found in red varieties to be the most satisfactory index to maturity. Yellow Newtown apples continued to increase in size up to about November 1, but the best keeping apples were secured in October 1 to 15 pickings. The early fruit, though smaller, retained its flavor and showed less spotting. Fruit picked September 20, October 13, and October 30 when examined April 4 showed 2.7, 9.1, and 40.7 per cent of breakdown, respectively, and on June 3 apples of the first two lots were still good.

With red raspberries no outstanding differences in canning quality could be determined between irrigation and nonirrigation. Fertilizer also had no effect. The best canning quality was associated with full maturity.

Under both favorable and unfavorable pollinating conditions the set of Anjou pears was increased by crossing with Bartlett and Easter Beurre. In a favorable locality Anjou selfed set 3.3, Anjou × Bartlett 37, and Anjou × Easter Beurre 34 per cent. White Doyenne (Fall Butter) pollen also gave good sets on Anjou.

[Horticultural investigations at the Southern Oregon Substation, Talent] (*Oregon Sta. Bien. Rpt. 1927–28, pp. 126, 127, 128*).—Of the many pear stocks tested the French pear *Pyrus communis* proved by far the most satisfactory. Selection work within this species revealed great variability in respect to vigor, type of root growth, and resistance to disease. Superior strains were isolated and propagated. Old Home and Variolosa are deemed highly promising pears to serve as blight-resistant trunks and framework stocks for improved varieties. The Japanese Sand pear and *P. ussuriensis* proved unsatisfactory on shallow or on heavy adobe soils. *P. calleryana* and *P. betulaefolia* are considered highly promising stocks, the latter being more resistant to alkali than is the French pear, and both are resistant to [illegible]

Experiments in cooperation with the Corvallis Station showed that the quality of pears can be improved and breakdown prevented by picking at the proper season, using the pressure tester as an index to maturity. A few exceptionally fine pears were found in the extensive station variety collection.

[Horticultural investigations at the Utah Station], F. M. Coe, A. L. Wilson, and T. H. Abell (*Utah Sta. Bul. 209 (1929), pp. 61–69*).—The usual biennial report (E. S. R., 56, p. 533).

At the Davis County Experimental Farm the Howard 17 proved the best early strawberry, and Marshall led in dessert quality. Information is presented on the cost of producing strawberries. Some progress was made in the selection of disease-resistant tomatoes, and certain strains of Livingston Stone showed marked resistance to Fusarium wilt. Cutting the seed bulbs of Sweet Spanish onions generally increased the amount of seed obtained, except in 1927, when the slower-growing whole bulb escaped severe injury by early frosts. Some slight progress was made in improving the Sweet Spanish onion by plant selection. Small bulbs of a high-grade strain yielded more seed than did any other strain. Evidence was secured that double onions tend to produce double onions. Bermuda onion plants purchased in Texas gave good results. The Utah celery proved superior to other varieties.

Studies of the internal breakdown and water core in apples showed severe water core and breakdown to be most prevalent in fruits from trees without adequate moisture. These troubles were found to be severe only in late pickings, indicating that early picking is desirable, especially for Jonathan designed for storage. Ground color change was found the best index to picking maturity. Pressure tests gave a wide range of readings between different orchards. The ease of separation of fruit from spur was found unreliable. Seed color when taken in conjunction with ground color gave some promise of usefulness. Work in peach maturity indicated that color and pressure tests are the most reliable indexes for harvesting.

Rootstock investigations indicated that Mazzard and Morello cherries do not lend themselves to propagation by root cuttings.

Hotbeds and coldframes, A. B. Fite and J. W. Rigney (*New Mexico Sta. Bul. 170 (1928), pp. 12, figs. 5*).—General information is presented upon the construction and management of hotbeds and coldframes.

Starting plants inside for earliness, J. H. Painter (*[Oklahoma] Panhandle Sta., Panhandle Bul. 3 (1929), pp. 12, 13*).—The use of hotbeds, coldframes, paper pots, etc., is discussed.

Mulch paper for vegetable crops is tested, J. B. Edmond (*Michigan Sta. Quart. Bul., 11 (1929), No. 3, pp. 115–117*).—A 1-year test of paper mulch placed on the ground just after the seeds were sown showed increases in total yield and earliness in the bean, cucumber, and sweet corn, and in total yield of cabbage, tomatoes, and peppers. Of the six crops the greatest gain from paper mulch was with cucumbers and the least with sweet corn. The paper mulch failed to exert significant influences on the total yields of beets, carrots, and lettuce. Paper mulched cucumber plants were apparently more resistant to certain diseases. The greatest benefit of paper mulch is apparently with warm season plants.

Fertilizer experiments with truck crops in southern Illinois, J. W. Lloyd (*Illinois Sta. Bul. 319 (1929), pp. 283–298, figs. 3*).—The results of a fertilizer study continued through two 3-year rotation periods with muskmelons, tomatoes, and sweetpotatoes showed beyond question the superior value of stable manure, particularly when supplemented with phosphorus. Large amounts of green manures failed to equal the stable product.

Based on the 6-year average, the largest yields of muskmelons were produced on the plats receiving manure alone or in combination, the maximum muskmelon yield being on the manure, limestone, and bone meal plats. In the case of the tomato the maximum average yield was secured on the manure, cover crop, limestone, and rock phosphate plats. This treatment also produced the most early ripe tomatoes. The maximum yield of sweetpotatoes (table grade) was secured from the use of manure and limestone. With melons, tomatoes, and sweetpotatoes limestone increased yields in 3, 5, and 4 of the 6 years, respectively, being most beneficial in the case of the tomato.

Comparing bone meal, raw rock phosphate, and superphosphate as sources of phosphorus, it was found that the raw rock phosphate ranked first. Differences were slight except with sweetpotatoes, where superphosphate gave notably lower production. Under the conditions, potash apparently had no particular influence on yields.

Vegetable varieties for the Panhandle, 1928, J. H. Painter (*[Oklahoma] Panhandle Sta., Panhandle Bul. 2 (1929), pp. 3–8*).—Brief comments are presented on the results of varietal and cultural tests with vegetables.

Relation of kernel density to table and canning quality in different varieties of maize, C. W. Culpepper and C. A. Magoon (*U. S. Dept. Agr., Tech. Bul. 97 (1928), pp. 16, figs. 2*).—Studies at Arlington Experiment Farm, Virginia, with various types of corn showed definite increases in density, as determined by specific gravity readings, during the period of development, attaining a maximum in the mature seeds. In the very early stages the densities were low, and there was little variation between types. Striking differences developed, however, with the approach of maturity, the sweet corns showing the lowest and the flint and waxy corns the highest densities. There was a close negative correlation between moisture content and specific gravity.

Canning tests of the various corns at different stages of development, as indicated by specific gravity, suggested that low density of sweet corns contributes to their desirability as canning material. Corns having a specific gravity of from 1.05 to 1.08 were apparently in the best condition for table use. Attempts to use the specific gravity of dry seeds as a forecast to the quality of the resulting crop gave doubtful results, but tests with water-soaked seeds gave more promise of success.

Marked varietal differences were noted in the behavior of mature air-dry seeds when soaked in water, both in the rate of water absorption and in the total quantity imbibed. The varieties of sweet corn absorbed large quantities of water and enlarged greatly, while other varieties, particularly of the flint type, absorbed moderate quantities of water with corresponding moderate enlargement. The flour corns absorbed moderate quantities of water but enlarged comparatively little. These changes were characteristic to type; for example, the seeds of the sweet corns decreased in specific gravity during soaking, while the varieties of the floury type increased.

Pimiento peppers, J. G. Woodroof and J. E. Bailey (*Georgia Sta. Bul. 150 (1929), pp. 31, figs. 9*).—In addition to tables presenting the results of chemical analyses of pimiento and bell peppers, the authors present a general discussion upon the culture and handling of the pimiento pepper crop. Among the points considered are seed treatment, plant production, general culture, harvesting and yields, insects and diseases, use of the pepper as a food for poultry, and other uses. The bulletin is a revision of Bulletin 140 (E. S. R., 46, p. 538).

Artificial ripening of fruits and vegetables, R. B. Harvey (*Minnesota Sta. Bul. 247 (1928), pp. 36, pls. 2, figs. 6*).—Briefly reviewing the developments leading to the use of ethylene as a medium in hastening the ripening of fruits and

vegetables, the author discusses the use of this gas in the ripening of bananas, pineapples, dates, persimmons, pears, apples, melons, tomatoes, celery, and miscellaneous tropical fruits, going into the physiological effects in certain species. Various other ripening agents, such as propylene, amylene, ethylene oxide, ethylene chloride, ethyl chloride, methylene chloride, propylene chloride, and the esters, were tested in comparison with ethylene, but with the exception of propylene gave unfavorable results either by blackening the epidermis or in leaving undesirable residual flavors.

Based on the fact that only a very small quantity of ethylene is required to ripen fruits, for example, 1 lb. of ethylene to 100,000 lbs. of bananas, the author concludes that the estimation of the amount of ethylene in the fruit is chemically impossible. With a molecular weight of 28.04, ethylene is described as highly diffusible, easily reaching the interior of the crates. Studies of the influence of ethylene on animals (guinea pigs) showed no deleterious effect, even when given in doses far greater than those resulting from food treatment. Practical suggestions are presented upon the use of ethylene.

[Fruit breeding at the South Dakota Station] (*South Dakota Sta. Rpt. 1928, pp. 23–25*).—Brief comments are presented on various apple, pear, cherry, rose, and other seedlings obtained in fruit-breeding studies (E. S. R., 60, p. 528).

Regional and seasonal distribution of moisture, carbohydrates, nitrogen, and ash in 2–3 year portions of apple twigs, H. P. Traub (*Minnesota Sta. Tech. Bul. 53 (1927), pp. 67, figs. 20*).—Separating the 2–3-year-old wood of apple trees into four portions (1) periderm, (2) cortex-phloem, (3) outer xylem and (4) inner xylem-pith, the author determined the regional and seasonal distribution of moisture, carbohydrates, nitrogen, and ash in each division and reached the general conclusion that analyses of the whole twig can not always yield an accurate picture of physiological changes. The outer xylem because of its greater relative abundance tended to overshadow the other complex tissues.

In respect to moisture content the cortex-phloem was always highest and the periderm lowest. The outer xylem is believed to function as the complex water-supplying tissue, its moisture content following the rainfall curve quite closely. Temporary declines in moisture content during the transition periods of spring and fall are thought to be related to chemical and physical changes in the protoplasm. Although following the same general trends as the xylem in respect to moisture changes, the cortex-phloem section was much more subject to fluctuation.

Concerning carbohydrates the total reserve content was uniformly higher in the woody tissues than in the cortex-phloem or periderm. The maximum in all tissues was reached in late autumn following leaf abscission. Pentosans formed a relatively large proportion of the total reserve carbohydrates. The total sugar content of the periderm and cortex-phloem was invariably higher than that of the xylem, but all tissues followed the same trends in variation. The increase in total sugars and decline in acid hydrolyzable hexosans in both the cortex-phloem and xylem at the approach of winter is deemed the outstanding phenomenon from the viewpoint of food storage. The author suggests that apple trees should be designated a sugar-storing rather than starch-storing trees.

The nitrogen trend was the same in all four lots of tissue, rarely rising above 1 per cent on a dry weight basis in the periderm or cortex-phloem and remaining below 0.5 at all times in the outer xylem and inner xylem-pith. The nitrogen maximum was reached in March and April. Amino nitrogen content was highest during the growing season and lowest in the dormant period, while the

nonamino or protein nitrogen followed a directly opposite course. Nonamino nitrogen was consistently higher in the cortex-phloem than in the periderm or xylem.

Ash content on a dry-weight basis reached its maximum in the cortex-phloem and minimum in the xylem tissues. Considerable fluctuations observed in ash content of the cortex-phloem and of the periderm were apparently directly associated with changes in reserve carbohydrates.

Nitrogen and carbohydrate distribution in organs of bearing apple spurs, A. E. Murneek (*Missouri Sta. Research Bul. 119 (1928), pp. 50, figs. 54*).—Determinations of the nitrogen and carbohydrate contents of leaves, new growth, and reproductive organs of bearing apple spurs collected at regular intervals throughout the growing season showed that the reproductive organs dominate either directly or indirectly the metabolism of the bearing spur complex. The flower parts, for example, were characterized by a marked increase in all active forms of carbohydrates and nitrogen. The very high percentages of total sugars and soluble nitrogens found in the expanded flowers lead to the assumption that sugars were obtained by hydrolysis of the starch. However, a considerable fraction of the soluble carbohydrates was apparently supplied by hemicellulose, which showed a conspicuous decline at this time. The concentration of soluble and total nitrogen in the spur at flowering indicates that nitrogenous substances are moved into the bearing spur. Both carbohydrates and nitrogen were apparently reabsorbed by the spur prior to the abscission of the dropping blossoms.

Following blooming the fruits that set apparently became the dominating organ of the spur. The fruits showed not only marked increase in size but in dry matter and in all forms of carbohydrates and nitrogen. Hemicellulose accretion in the fruit reached a maximum in midsummer, thence decreasing rapidly. Hemicellulose as well as starch is deemed a source of sugars in the flesh of the apple. The development of both leaves and fruit was characterized by an accumulation of water insoluble nitrogen. Throughout its growth the fruit showed conspicuously higher percentage distribution of total water-soluble nitrogen. Late in the season the fruit showed a high concentration of sugars, starch, and hemicellulose. Because of the large demand for nitrogen on the part of the fruit in its early development the authors suggest that thinning should be practiced as early as possible; that is, not be delayed much beyond the time of the June drop.

Removal of spray residue from apples and pears in the Pacific Northwest, H. C. Diehl, D. F. Fisher, H. Hartman, J. R. Magness, and R. H. Robinson (*U. S. Dept. Agr. Circ. 59 (1929), pp. 20*).—This circular, a joint contribution from this Department, the Oregon Experiment Station (E. S. R., 59, p. 743), and the Washington College Experiment Station (E. S. R., 59, p. 836), summarizes the situation at the present time both in regard to the actual cleaning of the fruit and the influence of cleaning treatments on the development of injuries and storage troubles. The procedure adopted in cleaning fruit by wiping and brushing and also by the use of solvents such as hydrochloric acid is outlined, with information on subsequent handling of the treated fruit and on the necessary precautions to be followed throughout the various operations.

Size of peaches and size of crop, V. R. Gardner, R. E. Marshall, and H. D. Hootman (*Michigan Sta. Spec. Bul. 184 (1928), pp. 27, figs. 12*).—Studies in peach orchards near South Haven, Berrien Springs, and Grand Rapids upon the effects of various types of pruning, fertilization, and fruit thinning upon the size of fruits, total yields, and net returns indicated quite definitely that any practice which substantially reduces yield also results in lower net returns.

The application of quickly available nitrogenous fertilizers was the only cultural treatment that substantially increased yields. This was accomplished both by increasing the potential fruiting surface and in weak trees by increasing the set. Only in years of light crops did fertilizers have any effect on the size of the peaches.

Comparatively light annual pruning of the so-called long type followed by rather severe heading once in every four to six years was found effective. Pruning of any type, particularly cutting back, increased the size of fruits in direct ratio to its severity, but unfortunately generally reduced total yields and returns per acre. Thinning of fruit also increased the percentage of large peaches but reduced yields, except where there was a heavy set, and is recommended therefore only when trees are overloaded. Peaches thinned to stand more than 3 in. apart failed to show any increase in yield.

Records obtained at packing houses indicated that only one-half to two-thirds of the commercial Michigan peach crop is of the A grade (minimum diameter 2 in.). Since there was an average difference of from 40 to 50 cts. per bushel between the 2-in. and the next smaller grade, size is obviously an important consideration.

Culture and outdoor winter storage of persimmons in the vicinity of Peking, China, P. H. and J. H. Dorsett (*U. S. Dept. Agr. Circ. 49 (1928), pp. 12, figs. 9*).—Based on an extended journey through the production area of China, the authors present a general picture of persimmon production as practiced by the Chinese, taking up in order the location and character of the orchards, varieties, diseases and insect pest control, girdling, harvesting and handling, open air storage, and marketing, and expressing the conviction that the growing of these types of persimmons might be greatly expanded in the United States.

Insects aid fruit setting of raspberry, S. Johnston (*Michigan Sta. Quart. Bul., 11 (1929), No. 3, pp. 105, 106, fig. 1*).—Records taken on four Cuthbert red and four Cumberland black raspberry plants inclosed in screen cages prior to blooming showed 72.6 and 9.8 per cent of the blossoms failing to set fruit, respectively, as compared with 34.1 and 0 per cent of failure outside. Likewise 42.9 per cent of the Cuthbert and 21.9 per cent of the Cumberland berries in the cages were imperfect as compared with only 2.8 and 1.7 per cent, respectively, outside. The Cumberland was obviously more capable of self-pollination than the Cuthbert.

Chrysanthemum breeding, E. D. Smith and A. Laurie (*Michigan Sta. Spec. Bul. 186 (1928), pp. 30, figs. 18*).—Tracing the early history and development of the chrysanthemum in Asia, Europe, and America, the authors present a classification of types, discuss the principles and practices of hybridization, and include a tabulated list of chrysanthemum varieties originated and disseminated by the firm of Elmer D. Smith and Company of Adrian, of which the senior author is the founder.

FORESTRY

Tree crops, J. R. Smith (*New York: Harcourt, Brace & Co., 1929, pp. XII+333, pls. 64, figs. 11*).—Deploring the tremendous loss of fertile soil by erosion of deforested and waste lands, the author discusses various trees and shrubs, notably nuts, pod-bearing legumes, oaks, etc., that might be utilized on these areas both as food and forest crops, thus increasing production and saving the soil from erosion.

Trees and forests of western United States, E. J. Hanzlik (*Portland, Oreg.: Dunham Ptg. Co., 1928, pp. 128, figs. 40*).—A concise presentation on the physiology of tree growth, the distribution of species, and the classification of

species, with a key to western conifers, supplemented with general information on the most important trees, their distribution, specific requirements, use of their wood, etc.

Rio Grande National Forest, Colorado (*U. S. Dept. Agr., Misc. Pub. 39 (1929), pp. [1]+13, figs. 14*).—With the purpose of stimulating interest in this forest area, descriptions are given of the outstanding features—scenery, forests, streams, etc., with notes on the lumber, game, and grazing resources. Fire and health regulations are included.

Pulp-timber resources of southeastern Alaska, B. F. HEINTZLEMAN (*U. S. Dept. Agr., Misc. Pub. 41 (1928), pp. 35, figs. 10*).—With the purpose of supplying information on the forest resources of southeastern Alaska as related to pulp and paper manufacture, the author discusses in detail the location, accessibility and characteristics of the region, the composition and volume of timber in the forests, present administration policies, water-power resources, existing forest industries, conditions governing timber sales, etc.

The principal forest types in the Knysna region: An outline, J. F. V. PHILLIPS (*So. African Jour. Sci., 25 (1928), pp. 188–201*).—The author offers a classification of forest types based on ground flora and soils.

Dunbar Station studies forestry practices, P. ROBBINS (*Michigan Sta. Quart. Bul., 11 (1929), No. 3, pp. 107–109*).—Brief notes are given on the character of the forest growth and upon demonstrational and experimental activities.

The Clearfield State Forest Tree Nursery, W. F. DAGUE (*Penn. Dept. Forests and Waters Bul. 47 (1928), pp. 31, figs. 15*).—The details of preparation, planting, and care of seed beds and the handling of young forest nursery stock are discussed.

Notes on some forest seeding experiments in the Rocky Mountains, J. E. KIRKWOOD (*Northwest Science, 2 (1928), No. 1, pp. 1–8*).—Studies at the University of Montana upon the viability of seed and rate of growth of seedlings of 24 species of gymnosperms and 29 species of deciduous trees propagated from seed obtained from widely different sources showed wide variation, apparently in accord with the source of the seed. In other words, the seedlings reflected the nature of the environment which surrounded their parents. Testing of seeds by the dissection method failed to give reliable results; for example, in *Pinus ponderosa* 91 per cent viability was shown by dissection, while only 10.4 per cent actually produced seedlings. In soil, rapidity of germination was directly associated with percentage of germination.

Pertaining to survival it was found that drying during the winter period was apparently a more potent cause of mortality than was actual cold. Causes of failure are believed to lie more in moisture than in temperature relations. Certain conifers, notably western yellow pine, showed indications of being able to survive if once thoroughly rooted, but attempts to afforest semiarid slopes with seeds, seedlings, and transplants of western yellow pine failed.

Some aspects of light in the forest, A. GRASOVSKY (*Yale Univ. School Forestry Bul. 23 (1929), pp. 53, pls. 7, figs. 4*).—Prefaced with a general discussion upon solar radiation and its physiological effects on plants, upon methods and instruments employed in measuring solar energy concerned in photosynthesis, and upon the results of pertinent experiments, this bulletin reports the results of experiments conducted at New Haven, Conn., and Keene, N. H., upon the light requirements of white pine, red pine, hemlock, red oak, and chestnut oak. The general conclusion is drawn that the intensity and quality of the light reaching the forest floor are not the determining factors in accounting for the nature of reproduction in fully stocked forests such as obtained in the study. The species under study survived for 10 months under a light intensity that was

not over 300 foot candles at any time. For white pine seedlings approximately 170 foot candles were required to balance the carbon dioxide lost in respiration and used in photosynthesis, and an additional 170 foot candles was apparently sufficient to maintain growth. The intensity of light under white pine canopies in the Yale Forest was found in excess of the minimum requirements of the seedlings tested. The tree seedlings lived and grew under various ranges of the visible spectrum provided they were supplied with adequate light intensity.

Length of tracheids in jack pine in relation to their position in the vertical and horizontal axes of the tree, D. A. Kribs (*Minnesota Sta. Tech. Bul. 54 (1928), pp. 14, figs. 3*).—Measurements taken on a total of 12,500 tracheids separated by maceration of wood samples taken at different heights on jack pine trees growing at Cloquet showed an increasing length from the base of the trees upward until a certain maximum height was reached. In the first annual ring lying next to the pith the tracheids increased rapidly in length from the base to the 21-ft. section after which the length remained practically constant. From the first annual ring to the fortieth the tracheids increased in length to the section at 41-ft. height then decreased in length to the top of the tree. From the forty-fifth to the eightieth annual ring the tracheids increased in length to the section at 31-ft. height and then remained practically constant to the top. The longest tracheids were found in the rings from the fiftieth to the bark in the higher parts of the tree or from the cross section at 31 ft. above ground to the top of the tree. Maximum tracheid lengths were found near the bark at the cross section 51 ft. above ground to the tree top. The tracheids of the summer wood were slightly longer than those of the spring wood.

Concerning Pinus merkusii [trans. title], C. B. Buys, C. Japing, and D. Fernandes (*Dept. Landb., Nijv. en Handel Nederland. Indië, Meded. Proefsta. Boschw., No. 19 (1928), pp. VIII+139, pls. 70; Ger. abs., pp. 135–139*).—Distinguished as being the only species of pine found growing naturally south of the Equator, *P. merkusii* is discussed in respect to distribution, rate of growth, regeneration, and yield of naval stores. Natural regeneration occurred freely on mineral soils, and light ground fires, by destroying humus and ground plants, facilitated reproduction. Propagation offered no difficulty on well-drained soils, either by sowing directly in situ or in prepared beds. In the latter case the seedlings were transplanted at 3 weeks and were ready for the field at from 6 to 8 months. In fertile soil trees measured 4 meters (13.1 ft.) 2 years after setting. On poor soils seedlings averaged about 2.5 meters at 3.75 years of age. The species was observed to sprout from the stump.

Tapping experiments showed *P. merkusii* to be highly productive, averaging threefold that of *P. palustris* in Florida and fourfold that of *P. maritima* in France. On well-stocked natural stands yields of 1,357 lbs. of resin per acre were secured. The turpentine and the resin of *P. merkusii* are described as of superior quality.

Table made to estimate spruce and balsam, P. W. Robbins (*Michigan Sta. Quart. Bul., 11 (1929), No. 3, pp. 110, 111*).—A volume table is presented for white spruce and balsam fir from 7 to 17 in. in diameter at 4.5 ft. height.

DISEASES OF PLANTS

Department of botany and plant pathology (*Oregon Sta. Bien. Rpt. 1927–28, pp. 97–101*).—Continuing investigations previously reported (E. S. R., 60, p. 745), brief accounts are given of some of the principal studies made during the biennial period.

In cooperation with the U. S. Department of Agriculture and the Utah and Montana Experiment Stations regional studies were made of the virus diseases

of potatoes. Rugose mosaic was found to be the most serious and common form of the diseases in Oregon, followed by leaf roll, mild mosaic, spindle tuber, witches'-broom, and giant hill. Tuber indexing and roguing were found to be the most practical means of reducing the diseases in seed stocks, and the planting of seed stock plats is recommended. By following this method it is claimed that rugose mosaic was reduced from 4.5 to 0.4 per cent in four seasons.

In the investigations of bulb diseases it was found that narcissus mosaic was infectious, and that it could be controlled by persistent roguing. Breaking of tulips was successfully transferred to unaffected plants by inoculation with leaf mutilation, by grafting, and by aphids. Control of aphids and roguing reduced the disease. Tulip fire, a fungus disease, was controlled by cleaning the bulbs before planting and crop rotations so that tulips did not occupy the same ground more frequently than once in three years.

A mosaic disease of bulbous iris is reported, for which roguing appeared to be the most practicable means of control.

Considerable attention was given to the curly top disease, and in addition to sugar beets, tomatoes, squash, beans, pepper, cucumber, cantaloupe, horseradish, spinach, zinnia, strawflower, and a number of weeds were found to be subject to attack. Resistant strains of beans and squash were found that are said to yield well in the presence of severe attacks of the disease.

Work was begun on the eradication of the leaf and stem nematode of strawberries. The cultivated teasel was found to be subject to attack, in some cases 80 per cent of the plants being infected. In this plant the parasite was found to be seed borne, and experiments were undertaken with the hot water treatment of the seed before planting.

Additional evidence was secured which indicates the more definite association of perennial canker of the apple tree with frost injury to tissues weakened by the woolly aphis.

The Verticillium wilt of black raspberry is considered to be one of the limiting factors in the production of that fruit in western Oregon. While the same fungus attacks both the black raspberry and the potato, preliminary experiments are said to indicate that the strain isolated from the raspberry was more virulent to that crop than the one isolated from the potato.

Laboratory experiments on the disinfection of fruits in connection with spray residue removal showed that formaldehyde and borax-boric acid solutions were the most effective of many solutions tested. By the proper use of machines for the removal of spray residues most of the fungus spores were found to be destroyed, and under such conditions the use of disinfectants is not recommended.

A strawberry root rot is reported in which as high as 100 per cent infection of plants was found. The cause of the disease and methods for its control are being investigated.

Botany and plant pathology, B. L. RICHARDS (*Utah Sta. Bul. 209 (1929), pp. 44–51*).—In addition to the virus diseases previously reported (E. S. R., 56, p. 540), two new ones, leaf-rolling mosaic and psyllid yellows, have been differentiated and their character studied. All experiments on the control of virus diseases were interrupted by the occurrence of the yellows.

Studies were continued on canning crop diseases, particular attention being given to Fusarium wilt, mosaic, western yellow blight, and bacterial canker. For the control of Fusarium wilt, a tomato selection from the variety Stone proved valuable not only by reason of its existence but also on account of its quality and possible earliness. Field tests for resistance were continued with 14 varieties of tomatoes, and Norton, which was previously quite resistant,

proved susceptible in 1926, probably on account of the fact that the seed had been produced on diseased soil. The occurrence of Verticillium wilt of tomatoes is said to have complicated the wilt problem.

An investigation of tomato mosaic is said to have shown the presence of two types of disease, one of which is becoming very serious in parts of the State. Greenhouse experiments showed that it was identical with streak, which is caused by combining the virus of tomato mosaic with that of rugose mosaic of the potato.

Preliminary work is said to have shown the definite connection of western yellow blight with the curly top of sugar beets.

Bacterial canker of tomatoes caused by *Aplanobacter michiganense*, which was first noticed in the State in 1923, is said to have become serious, causing a loss of about 12 per cent of the crop of canning tomatoes in Utah. Evidence was secured which indicates that the disease is seed borne.

Notes are given of a heart rot of celery that is attributed to excessive irrigation; eggplant wilt caused by *V. alboatrum*; and white spot of alfalfa, which is due, apparently, to improper irrigation. A similar disease of sweetclover is reported.

The psyllid yellows disease of potatoes is said to have appeared suddenly in 1927, and it spread to Colorado, Idaho, Montana, and Wyoming during the same season. The disease was most severe on the early crop, the entire plantings having been destroyed in some localities. It was found to be correlated with the presence of the psyllid (*Paratrioza cockerelli* Sulc.), but how the insect caused the disease was not determined.

Studies by F. B. Wann on chlorosis of orchard trees are said to suggest that a lack of nitrogen is probably a contributing factor in the production of the disease. The trouble seemed most common on well-drained gravelly soils, especially where they thinly covered the clay subsoils. Hydrogen-ion studies were made of the soil around normal and chlorotic pear and apple trees. Iron sulfate solutions injected into limbs of chlorotic trees were said to have been followed by severe burning and defoliation, but the following spring dark green foliage came out, which was in striking contrast with the leaves on untreated branches. Data were collected on the reducing and total sugars of chlorotic and normal blackberry leaves, and both were found to be much higher in the normal leaves.

Reciprocal transmissibility of beet and of spinach mosaic [trans. title], K. Böning (*Centbl. Bakt.* [etc.], *2. Abt., 71 (1927), No. 15–24, pp. 490–497, figs. 3*).—Mosaic of beet and that of spinach are found to be reciprocally transmissible by means of insect carriers, and the causal agents may prove to be identical.

Report on some diseases of tea and tobacco in Nyasaland, E. J. Butler (*Zomba: Dept. Agr. Nyasaland, 1928, pp. 30, pls. 4*).—These notes resulted from a visit to Nyasaland between February 15 and March 31, 1927, undertaken at the request of the Nyasaland Government mainly as a result of representations made on behalf of the tea planters in the Protectorate. The report deals mainly with the lowering of the tea crop due to diseases, and with relevant conditions. Of the fungi affecting the tea crop, *Armillaria mellea* is discussed as new to the area in question but as severe in some places.

A tobacco disease having the characters of the black stem rot of Sumatra was found in the Nyasaland districts of Cholo, Mlanje, and Zomba. The associated fungus was identified as *Pythium aphanidermatum*.

Other tea and tobacco diseases are briefly reported.

Relation of plant cankers to animal and human cancers [trans. title], C. STAPP (*Ber. Deut. Bot. Gesell., 45 (1927), No. 7, pp. 480–504, pls. 4*).—A somewhat comparative account of the beginnings, characters, and behaviors of anomalous growths in plants, in lower animals, and in man concludes by defining cancers (cankers?) as transplantable tumescences showing conspicuous hyperplasia with confused and insufficient vascularization, though having no recognizable irritant organism in place. The structural units show a deficiency in differentiation, degenerative nuclear alterations, and loss of polarity. Secondary tumors may arise naturally or may be produced by artificial means.

Root rots caused by Phycomycetes, C. J. BUISMAN (*Meded. Phytopath. Lab. "Willie Commelin Scholten," No. 11 (1927), pp. 1–51, pls. 2, figs. 12*).—In the course of studies relating originally only to Phycomycetes, the author has concluded that no sound reasons are evident either for regarding Pythiomorpha and Blepharospora as constituting new genera or against including these forms in the genus Phytophthora. A calla lily root rot causing serious damage in nurseries is said to be caused by a Phytophthora which is regarded as a new species, for which the name *P. richardiae* is proposed. A formalin corm treatment is proposed, as this has given practical results.

Pythium intermedium, isolated from chrysanthemum cuttings which had stopped growing, is also said to be strongly pathogenic to geranium cuttings. *P. splendens*, on inoculation, attacked chrysanthemum cuttings, and *P. debaryanum pelargonii* gave positive inoculation results with geranium and chrysanthemum cuttings. A Pythium having irregular oogonia was isolated and proved to be causal in the case of pea plants showing root rot, and this is described as *P. irregulare* n. sp.

In examining cases of typical "vlasbrand," ascribed to *Asterocystis radicis*, the author often found *P. megalacanthum*, which, it is thought, may prove to be at least partly causal. Various Phycomycetes isolated from parts of decaying plants grown in vegetable mold proved to be difficult to identify owing to the absence of oogonia or sporangia.

Corn ear rots (*South Dakota Sta. Rpt. 1928, pp. 5, 6*).—In continuation of a previous report (E. S. R., 58, p. 748), studies were made of a number of selfed strains of corn to determine correlations between certain characters of the strains and the occurrence of root rots. A number of characters of corn have been considered due to disease, and the correlation studies were said to indicate that characters like those of being easily pulled up by the roots and stalks leaning over or falling to the ground may or may not be associated with the diseased plants.

Oat rust damage severe in Upper Peninsula, B. R. CHURCHILL (*Michigan Sta. Quart. Bul., 11 (1929), No. 3, pp. 111–115*).—Attention is called to the extent to which the oat crop is frequently damaged by rust in the northern peninsula of Michigan. For the prevention of this loss the author recommends sowing early-maturing varieties, the use of fertilizers to induce early ripening, and the adoption of resistant varieties.

In testing varieties for rust infection it was found that oats derived from the Kherson or White Russian type were more resistant to the rust than those of any other types tested. Wolverine and Swedish Select were found to be comparatively susceptible to stem rust.

Greenhouse studies on the relation of age of wheat plants to infection by Puccinia triticina, C. O. JOHNSTON and L. E. MELCHERS (*Jour. Agr. Research [U. S.], 38 (1929), No. 3, pp. 147–157, pls. 3*).—Greenhouse experiments conducted at the Kansas Experiment Station are said to have shown that certain varieties of wheat, very susceptible to leaf rust physiologic form 9 in the seedling stage,

were highly resistant at heading time. A number of other varieties changed only very slightly or not at all in their reaction to rust. Varieties resistant or rust free in the seedling stage were found to be resistant at all stages of growth. Those varieties that changed in their reaction to leaf rust as they grew older showed their highest resistance in the uppermost leaves. Most of the varieties exhibiting this changing reaction to rust in the greenhouse also showed considerable resistance to leaf rust under field conditions.

Many hybrid plants and selections were found to show a changing reaction to leaf rust in different stages of growth. This was especially noticeable in hybrid plants that were heterozygous with respect to their reaction to rust.

The experiments are said to emphasize the fact that many promising varieties, strains, and hybrids may be discarded if only the seedling stage of rust is tested. Latent resistance was found in varieties representing the most important types of the common bread wheats.

Smut-control test, A. F. BRACKEN (*Utah Sta. Bul. 209 (1929), p. 22*).—A comparative test of the effect of various seed treatments of wheat on yield is said to have given inconclusive results.

In another series of experiments with smutted wheat, the crop treated with copper sulfate showed 1.2 per cent smut; with 50 per cent copper carbonate, 1.8 per cent; with 20 per cent copper carbonate and with formalin, each 4 per cent; and with Dupont Dust, 11.8 per cent smut. Untreated seed produced a crop that was 72.6 per cent smutted. A crop from ordinary field seed treated with 20 per cent copper carbonate was said to have been completely free from smut.

Nutritional studies on Fusarium lini, E. S. REYNOLDS (*Plant Physiol., 1 (1926), No. 2, pp. 151–164, figs. 3*).—Data from culture studies reported are considered to indicate that the cause of resistance shown by strains of flax to *F. lini* is a chemical condition. The extract from the resistant flax, when passed through the filter cylinder, depressed the growth of the flax wilt fungus more than did the extract from the susceptible variety. Since the same types of extracts when autoclaved accelerated growth it is thought that the growth-depressing factor is a relatively labile or a volatile compound. It is known that in the young flax plant the glucoside linamarin, or phaseolunatin, is present, and that the juices of crushed flax plants change this into glucose and the volatile hydrocyanic acid. The resistant strain contains more glucoside than does the nonresistant.

The explanation of resistance offered as possible is that the flax wilt fungus in invading a resistant flax plant with a relatively high linamarin content might release sufficient hydrocyanic acid to inhibit its own growth completely or partially, while in the more susceptible strains a sufficient production of the poison may not occur to prevent the establishment of the fungus. Comment is made on recent work by others. Observations have shown that resistance in flax is a relative and not an absolute quality, which would be explained by the facts elsewhere presented by the author (E. S. R., 55, p. 630), said here to show that the fungus grows in cultures that contain the equivalent of at least a 0.03 M concentration of KCN, but is considerably hindered in much higher concentrations. Further work is indicated as contemplated.

Investigations on the leaf-roll and mosaic diseases of the potato, P. A. MURPHY and R. MCKAY (*[Irish Free State] Dept. Lands and Agr. Jour., 26 (1926), No. 1, pp. 1–8, pls. 2*).—Indicating a continuation of previous studies, some of which have been noted (E. S. R., 51, p. 652), the authors deal herein mainly with phases of more or less practical interest, including the identification of different virus diseases, methods used in producing seed potatoes free from

[Pear blight investigations at the Southern Oregon Branch Station] (*Oregon Sta. Bien. Rpt. 1927–28, pp. 127, 128*).—Tests of 34 species of pears are said to have shown that only about 5 had sufficient resistance to blight to warrant further investigation. Each of the 5 species produced some individuals that were immune to blight, but many of the seedlings have not been found resistant. One variety of *Pyrus communis* is said to have produced a higher percentage of seedlings resistant to the root form of blight than is found in the usual run of imported stocks, and experiments are in progress to determine, if possible, the staminate parent of this variety.

Five years' spraying experiments with Bordeaux mixture for the control of pear blight have shown a marked reduction in the number of blight infections in the plants sprayed with a 6–12–100 solution applied just before and again immediately after blooming. Some experiments were in progress to determine whether the spray could be applied earlier in the season and thus prevent the russeting on certain varieties in some seasons.

Decay of fruit in storage (*Oregon Sta. Bien. Rpt. 1927–28, p. 80*).—Experiments carried on in cooperation between the departments of chemistry, horticulture, and plant pathology of the station are said to have shown that of about 50 disinfectants tested for the prevention of decay in fruits, especially apples in storage, formaldehyde proved the most satisfactory for commercial use. It is said that there was practically no loss in the strength of the solution used at temperatures up to 110° F., and the concentration was not appreciably reduced after dipping 100 boxes of fruit in the disinfectant.

The acid treatment of pears and apples for the removal of arsenical residues was found to reduce storage losses from decay.

Observations on grapevine apoplexy [trans. title], A. García López (*Bol. Estac. Patol. Veg. [Inst. Agr. Alfonso XII, Madrid], 1 (1926), No. 4, pp. 129–136, figs. 5*).—Noting the memoir contributed by Viala on the grape stock disease due to *Stereum necator* and called by him esca (E. S. R., 58, pp. 249, 250), the present author adds certain observations made in Spain on this disease, for which the name yesca is regarded as appropriate.

Grape sclerosis [trans. title], P. Viala and P. Marsais (*Ann. Inst. Natl. Agron., 20 (1927), pp. 76–135, figs. 52*).—A systematic account in detail is given of grape sclerosis (*Sordaria uvicola*), previously noted (E. S. R., 58, p. 348).

The fungicidal action of ultra-violet radiation, H. R. Fulton and W. W. Coblentz (*Jour. Agr. Research [U. S.], 38 (1929), No. 3, pp. 159–168, pls. 3*).—An investigation was made of the possibility of utilizing ultra-violet radiation for reducing or retarding the decay of citrus fruits, especially the rot caused by *Penicillium digitatum*.

Preliminary experiments of spores of 27 miscellaneous species of fungi exposed for 1 minute to ultra-violet radiations from a quartz-inclosed mercury-tungsten arc at a distance of 6 in. showed that there was complete killing of the spores of 16 species, a survival of less than 1 per cent in the case of 4 species, and survival ranging from 2 to 53 per cent for the remaining 7 species. Mycelium from germinated spores was found to be more easily killed than the resting spores.

When oranges were directly exposed to the ultra-violet radiation it was found that Penicillium spores on the surface were killed in large proportions by intermittent short exposures to ultra-violet rays, and the exposure in the dosages used did not cause any apparent injurious effect on the oranges. In holding tests, decay of inoculated oranges was only moderately retarded by applications of ultra-violet rays that seem to reach the limit of economical practice under present conditions for time of exposure and distance from lamps. The principal

physical limitation to the use of ultra-violet rays seems to be their inability to penetrate much, if any, below the surface, so as to destroy mycelium that may have started infection.

The shorter wave-length components of the ultra-violet spectrum were found to have the greatest fungicidal action, while the longer wave lengths have relatively weak fungicidal power and require greatly prolonged exposures for the killing effect.

Botrytis disease of peony [trans. title], F. H. van Beyma Thoe Kingma (*Meded. Phytopath. Lab. "Willie Commelin Scholten," No. 11 (1927), pp. 60–66, figs. 4*).—A study of young peony plants showing diseased conditions resulted in a revision of the description of *B. paeoniae* given by Oudemans (E. S. R., 9, p. 457).

White-pine blister rust: A comparison of European with North American conditions, P. Spaulding (*U. S. Dept. Agr., Tech. Bul. 87 (1929), pp. 59, figs. 22*).—The author made an investigation of the white pine blister rust caused by *Cronartium ribicola* in various countries of northern and western Europe, and in this publication a comparison is made between the conditions in North America and Europe which influence the disease.

It is said that in Europe, except for limited areas, the white pines are entirely introduced and that Ribes are practically lacking in the wild state, except for special areas where they appear in a limited extent. Cultivated Ribes are common, and *R. nigrum* is said to be a great favorite and found practically everywhere that the species will grow. Practically all the white pine infections seen in Europe were considered due to this host plant.

Pinus strobus is reported to be the favorite pine host to the fungus throughout Europe, and, so far as the discontinuous distribution of the species permits, it is generally infected.

Certain species of white pines are resistant to the blister rust, among them *P. cembra helvetica*, *P. peuce*, and *P. excelsa*. The author suggests that these species be tested in the United States in large numbers and in different places so that their forestry qualities, as well as their resistance to the disease, may be determined.

Brunchorstia destruens on Pinus laricio corsicana and in pure culture [trans. title], A. van Luijk (*Meded. Phytopath. Lab. "Willie Commelin Scholten," No. 11 (1927), pp. 52–57, figs. 5*).—A report is made as a preliminary to inoculation studies. The disease is destructive.

ECONOMIC ZOOLOGY—ENTOMOLOGY

The European birds of prey, F. Engelmann (*Die Raubvögel Europas. Neudamm: J. Neumann, 1928, pp. XIV+834, pls. 36, figs. 369*).—The first part of this work deals with the natural history of the various birds of prey (pp. 1–508). This is followed by the mythology and cultural history (pp. 509–590). The work closes with an extended account of the practice of falconry (pp. 591–825).

Precipitin reactions with various tissues of Ascaris lumbricoides and related helminths, G. A. Canning (*Amer. Jour. Hyg., 9 (1929), No. 1, pp. 207–226*).—The author reports upon experimental work in which a comparison is made of (1) the various tissues of *A. lumbricoides* and (2) homologous tissues of related helminths.

Foibles of insects and men, W. M. Wheeler (*New York: Alfred A. Knopf, 1928, pp. XXVI+217+XI, figs. 56*).—Following an introduction, the author deals with the physiognomy of insects (pp. 1–45); insect parasitism and its peculiarities (pp. 47–67); a solitary wasp (*Aphilanthops frigidus* F. Smith)

that provisions its nest with queen ants (pp. 69–82); a study of the guest ant *Leptothorax emersoni* (pp. 83–126); the ant colony as an organism (pp. 127–143); the kelep ant and the courtship of its mimic, *Cardiacephala myrmex* (pp. 145–165); the organization of research (pp. 167–185); the dry-rot of our academic biology (pp. 187–204); and the termitodoxa, or biology and society (pp. 205–217).

Methods and principles for interpreting the phenology of crop pests, L. R. Tehon (*Ill. Nat. Hist. Survey Bul., 17 (1928), Art. 9, pp. 321–346, figs. 18*).—Included in this account are discussions of the thermohyetics of the beet leafhopper and sugar beet curly top, thermohyetics of the cucumber beetles and the bacterial wilt of melons, and significance of hythergraphs. A list of 21 references of the literature is included.

[Report of work with economic insects and their control at the Oregon Station] (*Oregon Sta. Bien. Rpt. 1927–28, pp. 101–109, 118, 119, 128, 129*).—A brief reference is made to work with the strawberry root weevils and their control, an account of which has been noted (E. S. R., 57, p. 263). A species additional to those mentioned in the circular, namely, *Dyslobus decorata* Lec., is said to have been found causing severe damage.

In codling moth work in 1927 from 18 to 25 per cent of the apples were wormy where oil sprays were used, but there was only 4 per cent wormy fruit where lead arsenate was applied. The tests of that year indicated that oil has value as an ovicide, but that where used throughout the season in sufficient quantity to control the codling moth serious injury to the fruit is likely to result.

Reference is made to the introduction of the tachinid parasite *Digonochaeta setipennis* from Europe as an enemy of the European earwig and the liberation of 189 gravid females under natural conditions of earwig infestation in different parts of Portland.

In control work with the onion maggot, corrosive sublimate 1:1,000 applied to the plants every week for 5 weeks, beginning when the plants were 1 in. high, gave a satisfactory increase in yield in the 1927 season. This, however, is a rather expensive treatment and is not warranted unless the indications are that the infestation will be severe.

Life history and control work with the gooseberry borer (*Xylocrius agassizii* Lec.) was continued (E. S. R., 60, p. 752). The application of 1 oz. of paradichlorobenzene per plant in August gave promising results.

In work with the narcissus bulb flies it has been found that the lesser bulb fly can be kept in check, particularly through application of the hot water treatment, but that an effective control measure is needed for the greater bulb fly.

Studies of the Syneta leaf beetle (*S. albida* Lec.) on cherries in the Willamette Valley were continued (E. S. R., 60, p. 752). The work showed that the percentage of injury to the fruit can be reduced about 70 per cent by the application of several dusts and sprays, a spray of lead arsenate (4:100) having proved as effective as any of the materials tried when the trees were thoroughly sprayed.

Experimental control work with the pear thrips on prune, commenced in the spring of 1926, has shown that the application of suitable spray materials early in the season will control the thrips to a certain extent and insure an average set of the fruit.

Control work with the rosy apple aphid was continued (E. S. R., 60, p. 752) without definite conclusions being drawn as to the value of the sprays employed.

Further work with the codling moth was directed toward the obtaining of substitutes for lead arsenate, a comparison of varying strengths of lead arsenate with and without spreader, and dust spraying v. liquid spraying. The regular spray calendar was followed. Calcium arsenate and manganar each gave as good control as lead arsenate, while fluosilicates gave practically no control. Where Black Leaf 40 was substituted for the lead arsenate in the last cover spray, the number of clean apples was reduced slightly. The results indicate that there is a possibility of obtaining a satisfactory substitute for lead arsenate. In work in the use of lead arsenate with and without spreader, there was found to be a slight increase in control where the spreader was used and a decrease where the last cover spray was omitted. Dusting with 80–20 sulfur-lead arsenate mixture gave 85 per cent clean fruit, 5 per cent wormy fruit, and 10 per cent stings, whereas plats dusted with calcium arsenate gave 86 per cent clean fruit, 7 per cent worms, and 7 per cent stings, with no apparent injury. Unsprayed checks were found to yield 8 per cent clean apples and 92 per cent worms and stings.

Studies of the life history and control of the symphilid *Scutigerella immaculata* Newp. are briefly reported upon.

In arsenical residue studies at the Hood River Substation, the use of lime was found to offer promise of arsenical removal on account of its favorable reaction with the acid wash. In strawberry root weevil control an apple bait made up with 95 per cent apple chop with which 5 per cent calcium arsenate was thoroughly mixed is said to have given complete control where two applications were made, one just before the bloom period and the other the latter part of June. Nicotine-casein combinations were found more effective as sprays for the woolly aphid than summer oil applications. Two species of thrips, *Frankliniella occidentalis* and *Aeolothrips fasciatus*, often cause extensive damage to apples in the Hood River district, and investigation of them is under way.

Work at the Southern Oregon Substation at Talent reported upon relates to studies of the codling moth, red spider, San Jose scale, and insecticides. The effectiveness of the oil and arsenate of lead combinations in codling moth control is said to have been demonstrated and the ineffectiveness of oil alone shown. Oil in combination with lead arsenate resulted in as high as 15 per cent cleaner fruit than when arsenate of lead was used alone. All of the oils used on Newtown apples by this station caused considerable injury to the fruit, and many of them injury to the foliage. The red spider became a major pest in orchards during the past 3 years, and control work is under way. In control work with the San Jose scale, injury from fall applications of oil sprays amounted to as much as 100 per cent kill of fruit and leaf buds of the pear variety Winter Nelis and lesser amounts of injury on other commercial varieties of pears, but no injury has been observed to follow fall applications of oil to Newtown. In experiments with lime sulfur during 1927 and 1928 dry lime sulfur at a strength of 30 lbs. to 100 gal. of spray material was found less than one-half as effective as full strength liquid lime sulfur at 1–8. Liquid lime sulfur 1–16 has given better control than dry lime sulfur 30 lbs. to 100 gal. of spray at less than half the cost for spray materials.

[Report of work in entomology at the South Dakota Station] (*South Dakota Sta. Rpt. 1928, pp. 16–19*).—Brief accounts are given of work under way with the common black field cricket, the plum tree borer, and grasshoppers of the subfamily Cyrtocanthacrinae occurring in South Dakota, their distribution, life history, economic importance, natural enemies, and control. The conclu-

sions drawn from a study of the pollinating agents of sweetclover in the State, with special emphasis on seed production as influenced by the honeybee, follow.

[Work with economic insects at the Utah Station] (*Utah Sta. Bul. 209 (1929), pp. 54–57*).—Brief notes are given by H. J. Pack on observations of insects of importance in the State, including the sugar beet root maggot (*Tetanops aldrichi* Hend.); field ants; the squash bug; strawberry root weevil (*Otiorhynchus ovatus* L.), effective control of which was obtained by the use of magnesium arsenate when dried apples were used as a carrier, and with which calcium cyanide "A–Dust" gave very effective control on heavy vines in the absence of wind; wheat jointworms (*Harmolita grandis*, *H. vaginicola*, *H. tritici*); gooseberry fruit worm (*Zophodia franconiella* Hulst), which has become very serious in Utah, taking from 50 to 75 per cent of the crop in some regions; and the tomato psyllid *Paratrioza cockerelli* Sulc.

A more detailed account is given by C. J. Sorenson of the progress of work with the chalcid fly in alfalfa seed, commenced in the spring of 1926, as previously referred to (E. S. R., 56, p. 553). In an investigation of the extent of infestation, in 1926 it was found to range from 2 to 38, with an average of 9.41 per cent, representing an estimated loss of $254,285. The infestation of samples collected from 90 representative seed fields in 1927 ranged from 0.76 to 36.84 per cent, and averaged 9.67 per cent. Brief reference is made to studies of the life history and habits of the pest and parasitism of it. In considering means of control it is stated that the investigations have shown great numbers of chalcid flies to have passed the winter in infested seed which was blown over into the chaff stacks during threshing, and that these chaff stacks, when left standing in the fields after about May 15, are responsible for increased numbers of chalcid flies in the seed fields during the summer. Volunteer alfalfa growing in the waste places forms a source of infestation, and such alfalfa should be prevented from going to seed.

Reference is made by G. F. Knowlton to the progress of an investigation of the beet leafhopper. Studies of its source have shown that enormous numbers develop each season on Russian thistle, the most important host plant in Utah. Curly top was so severe in 1926 that fewer than one-half of the Utah sugar factories were operated. The leafhoppers were abundant in the early spring in 1927 in many parts of the State, and some areas suffered badly. In most areas, however, the damage did not occur until late in the season after the beets had attained fair size, and a fair tonnage was usually obtained. In the spring of 1928 the pest was slightly more numerous in beet fields of Box Elder County and at Hooper, but less abundant in most parts of Davis, Salt Lake, and Utah Counties.

Economic insects in Sweden in 1927 [trans. title], O. Lundblad (*Meddel. Centralanst. Försöksv. Jordbruksomrädet [Sweden], No. 337 (1928), pp. 33, fig. 1*).—This is a report on the occurrence of and work with the more important insects and other animal pests in Sweden in 1927 (E. S. R., 57, p. 655).

Locusts and grasshoppers: A handbook for their study and control, B. P. Uvarov (*London: Imp. Bur. Ent., 1928, pp. XIII+352, pls. 10, figs. 118*).—The general part of this work deals with external morphology, anatomy and physiology, development and transformations, behavior, ecology and distribution, natural enemies, periodicity of mass outbreaks, the technique of control, and organization of control. The special part deals with the Moroccan locust (*Dociostaurus maroccanus* Thnbg.) and the locust problem in Spain, Anatolia, Transcaucasia, and Turkestan; the migratory locust (*Locusta migratoria* L.) and the locust problem in Russia and the Tropics of the Old Word; the desert locust (*Schistocerca gregaria* Forsk.) and the locust problem in north and east Africa and in western Asia; the South American locust (*S. paranensis* Burm.)

and the locust problem in South and Central America; the brown locust (*Locustana pardalina* Wlk.), the red locust (*Nomadacris septemfasciata* Serv.), and the locust problem in South Africa; the Italian locust (*Calliptamus italicus* L.); solitary grasshoppers and the grasshopper problem in Siberia and North America; the locust and grasshopper problem in Australia; and miscellaneous grasshoppers and species that swarm occasionally. A bibliography of 16 pages and a subject index are included.

The German fauna.—VI, XI, XIII, Diptera, I–III, edited by F. DAHL (*Die Tierwelt Deutschlands. 6. Teil, Zweiflügler oder Diptera, I. 11. Teil, Zweiflügler oder Diptera, II. 13. Teil, Zweiflügler oder Diptera, III. Jena: Gustav Fischer, 1927, pt. 6, I, pp.* [4]+*172, figs. 121; 1928, pts. 11, II, pp.* [3]+*135, figs.* [225]; *13, III, pp. IV+232, figs.* [115]).—Part 1, by M. Hering, deals with the Agromyzidae; part 2, by F. Hendel, consists of a general account of the Diptera; and part 3, by O. Karl, deals with the Muscidae.

Diptera Brachycera and Athericera of the Fiji Islands, M. BEZZI (*London: Brit. Mus. (Nat. Hist.), 1928, pp. VIII+220, figs. 54*).—The author erects 9 genera and describes 137 forms as new to science.

The ox warble flies—Hypoderma bovis De Geer, Hypoderma lineatum De Villers, D. C. MOTE (*Ohio Sta. Bul. 428 (1928), pp. 45, figs. 12*).—This is a summary of information presented under the headings of introduction, hosts, effects of the warble flies on man and animals, economic importance, distribution, biology and habits, larvae in the gullet and spinal canal, emergence of the adults, combating the warble flies, and *H. bovis* and *H. lineatum* differentiated. A list is given of 46 references to the literature.

The mosquitoes of the Americas, H. G. DYAR (*Science, 68 (1928), No. 1768, pp. 485, 486*).—This is a review by L. O. Howard of the work previously noted (E. S. R., 59, p. 859).

The composition of water and mosquito breeding, W. RUDOLFS and J. B. LACKEY (*Amer. Jour. Hyg., 9 (1929), No. 1, pp. 160–180, figs. 6*).—This is a contribution from the New Jersey Experiment Stations, in which an attempt is made to correlate the chemical composition of water and the biological growth contained in it with the abundance of mosquito breeding (E. S. R., 57, p. 755).

Phlebotomus and Oroya fever and verruga peruana, H. NOGUCHI, R. C. SHANNON, E. B. TILDEN, and J. R. TYLER (*Science, 68 (1928), No. 1769, pp. 493–495*).—The authors report upon tests conducted which led to the conclusion that the chain of evidence uniting Phlebotomus with Oroya fever and verruga peruviana has been completed.

[Lepidoptera of Japan] (*Jour. Facult. Agr., Hokkaido Imp. Univ., 21 (1928), No. 4, pp. 121–176, pls. 3*).—In the first of the two papers here presented J. Shibuya deals with the Japanese Crambinae (pp. 121–147). The second paper is a report on The Systematic Study on the Japanese Pyralinae, by J. Shibuya (pp. 149–176).

Zoophilous moths, R. C. SHANNON (*Science, 68 (1928), No. 1767, pp. 461, 462*).—The author reports upon the collection of a number of moths in Argentina found to light upon the lower eyelid of the horse and feed upon the secretions. The irritation resulting is said at times to cause temporary blindness.

Diseases of the silkworm: Grasserie and dysenteries, A. PAILLOT (*Les Maladies du Ver à Soie: Grasserie et Dysenteries. Lyon: Éd. Serv. Photog. Univ., 1928, pp. 328, pls. 32, figs. 18*).—In the introduction the importance of losses caused by diseases of the silkworm, general method of work, importance of histopathological and cytopathological investigations, and general research technique are considered. Part 1, which follows, deals with the normal histol-

ogy and cytology of some organs of the silkworm (pp. 19–46); part 2 with grasserie, including personal investigations (pp. 47–147); and part 3 with intestinal diseases of the silkworm (pp. 149–305). A bibliography of 18 pages is included.

The European corn borer and its environment, L. L. HUBER, C. R. NEISWANDER, R. M. SALTER, ET AL. (*Ohio Sta. Bul. 429 (1928), pp. 196, figs. 20*).—The studies here presented are considered in six parts.

Following part 1 (pp. 5–7), an introduction, part 2 (pp. 9–12) gives a quantitative study of the accumulation and abundance of the European corn borer, by Neiswander and Huber. In part 3 (pp. 13–81), a description of the behavior of each stage of the European corn borer, the life history is dealt with by E. G. Kelsheimer and Neiswander (pp. 13–15); the adult, by Huber, Kelsheimer, J. R. Savage, and Neiswander (pp. 15–33); the egg, by J. B. Polivka and Savage (pp. 33–37); the larva, by Neiswander, Polivka, W. V. Balduf, and Huber (pp. 38–80); and the pupa, by Polivka and Kelsheimer (pp. 80, 81).

Part 4 (pp. 83–106) deals with an analysis of environment with special reference to mechanics, in which treatment of stubble is taken up by Neiswander and Kelsheimer (pp. 83–95); treatment of the cut fodder and standing stalks, by Polivka, Kelsheimer, and Huber (pp. 96–105); and insecticides, by Polivka (pp. 105, 106). Part 5 (pp. 108–149) deals with environmental factors—the corn borer and its host plants, in which the development and yield of corn with respect to soil and climate is considered by F. A. Welton and Salter (pp. 108–115); development and yield of corn with respect to varieties and rate and date of planting, by L. E. Thatcher and J. T. McClure (pp. 115–121); development and yield of corn with respect to cultural and soil practices, by Salter, McClure, and Neiswander (pp. 121–127); correlation of corn borer population with corn development, by Neiswander, Polivka, and Huber (pp. 128–143); corn breeding in relation to the corn borer problem, by M. T. Meyers, J. S. Cutler, and Neiswander (pp. 143–147); and damage resulting from corn borer attack, by Polivka and Kelsheimer (pp. 148, 149).

Part 6 (pp. 152–187) consists of ecological interpretations, in which original associations as indexes to biotic habitats with special reference to the corn borer are considered by H. C. Sampson and E. N. Transeau (pp. 152–163); soil fertility and soil types as indexes to biotic habitats, by G. W. Conrey (pp. 163–168); correlation of borer population with vegetation types, by Neiswander, Sampson, and Kelsheimer (pp. 169–171); correlation of borer population with soil fertility and soil types, by Conrey, Polivka, and Huber (pp. 171–178); and influence of climate on corn borer abundance, by Huber, Neiswander, and Savage (pp. 178–187).

A summary, a list of 31 references to the literature, and a subject index are included.

The host plants of the European corn borer in New England, B. E. HODGSON (*U. S. Dept. Agr., Tech. Bul. 77 (1928), pp. 64, figs. 34*).—This is a detailed report of studies of host plants of the two-generation form of the European corn borer, of which more than 200 are now known. It is occasionally a pest of economic importance on plants other than corn, any of which might become important should the borer reach a section of the country where they commonly occur. It is pointed out that every cultivated host plant may act as a carrier of the insect, and that all host plants, especially the weeds and wild plants, may harbor and help perpetuate the pest.

The larvae may attack any or all parts of the plant, the stems being most frequently infested. The injury, the appearance of which is usually character-

istic, often results in the partial, sometimes in the total, destruction of the plants. The hosts may be attacked by borers of either or both generations, and all immature stages of the insect have been found on many of them. The seasonal development, characteristics, environment, frequency, and distribution of plants affect their infestation.

The plants are discussed and classified as to their frequency of infestation and as to their status as hosts to the borer. Included is a complete list of the plants upon which the borer has been found, showing these classifications, the generations and stages of the insect found on each, and the parts of the plant attacked.

It is pointed out that the one-generation strain occurring in the more western infestations has different food-plant habits.

Imported parasites of the European corn borer in America, D. W. Jones (*U. S. Dept. Agr., Tech. Bul. 98 (1929), pp. 28, figs. 24*).—This summary of information on imported parasites is presented under the headings of the reason for parasite introduction; the organizing of the corn-borer parasite project; the important introduced parasites; laboratory breeding methods; and importation, liberation, and recovery of the parasites.

Ten species encountered in European investigations have been considered of sufficient importance to justify importation into and liberation in this country, namely, the tachinids *Masicera senilis* Rond. and *Zenillia roseanae* B. & B.; the ichneumonids *Eulimneria crassifemur* Thom., *Dioctes punctoria* Roman, *Exeristes roborator* Fab., and *Phaeogenes planifrons* Wesm.; and the braconids *Microbracon brevicornis* Wesm., *Microgaster tibialis* Nees, *Apanteles thompsoni* Lyle, and *Macrocentrus abdominalis* Fab.

The numbers liberated and recoveries made are shown in detail in appended tables.

Borer damages golden glow plants, E. I. McDaniel (*Michigan Sta. Quart. Bul., 11 (1929), No. 3, pp. 124–126, figs. 2*).—This is a brief account of the goldenglow borer, *Epiblema carolinana*, which somewhat resembles the European corn borer in a superficial way and whose life history corresponds rather closely with that of the single-brooded race. An account of this insect by Thompson has been noted (E. S. R., 60, p. 844).

The moths appear in Michigan about the first of July, although adults have been taken as late as the middle of August. "The females live for about 2 weeks, during which time each individual places from 25 to 50 eggs singly in the blossoms of goldenglow. These eggs hatch in 4 or 5 days, and the tiny larvae feed within the flower until after the third instar, when they descend to the ground, letting themselves down by silken threads. Each one then searches out a plant and usually enters the stalk 2 or 3 in. above the soil. From this point it works down to the main roots, where it excavates a large tunnel. The larvae, like those of the European corn borer, reach maturity before cold weather sets in, though they remain in the underground tunnels until spring, when pupation takes place.

"Little or no injury has thus far been attributed to this species, though, when young buds are attacked, such buds occasionally develop into one-sided flowers. The larvae, after they enter the roots, seldom attract attention because most of the larvae are in the main roots where there is sufficient material to support both borer and plant."

Control consists in cutting and destroying infested flowers and buds while the larvae are small and before they reach their third instar. After the larvae get into the main root system they are too deeply embedded in the plant tissue to be controlled by contact insecticides. Unless the infestation is unusually

severe, parasites will usually keep the percentage of borers down to a safe number.

The southern corn rootworm, D. Isely (*Arkansas Sta. Bul. 232 (1929), pp. 31, figs. 13*).—This is a summary of information on the southern corn rootworm, officially known as the spotted cucumber beetle. The account is based upon biological studies conducted largely during the summer of 1927, supplemented by greenhouse studies during the winter of 1927–28, and field records obtained each year since 1923. It includes a review of the literature, a list of 37 references to which is appended.

Technical descriptions are given of the several stages of the pest. Much of the data on its biology is presented in tabular form. There is found to be a high negative correlation between temperature and the rate of development of the immature stages. The time required for development from egg to adult at temperatures prevailing in April and May may exceed two months, while in midsummer it may be less than one month.

It is pointed out that to avoid injury by the spotted cucumber beetle in Arkansas the bottom lands to be planted to corn should be kept free from wild grasses at least a month before planting. Fields susceptible to damage should not be planted to corn until June 1. When heavy precipitation continues until June and it is not possible to keep wild grasses out of fields before planting, some crop other than corn should be grown.

Field studies in the behavior of the non-social wasps, P. Rau (*Acad. Sci. St. Louis, Trans., 25 (1928), No. 9, pp. [3]+325–489, figs. 43*).—This work deals with 23 species of solitary wasps studied in the vicinity of St. Louis between the years 1917 and 1923.

ANIMAL PRODUCTION

Phosphorus deficiency in forage feeds of range cattle, S. G. Scott (*Jour. Agr. Research [U. S.], 38 (1929), No. 2, pp. 113–130*).—Samples of grasses from sections of Montana reporting cattle with depraved or perverted appetites as manifested by the eating of materials, including bone, which are not ordinarily classed as food, were analyzed for their mineral content by the Montana Experiment Station, as well as samples of hay, water, and soil from these areas. The samples were collected over a period of three years for purposes of comparison. Samples of grasses from areas where no mineral deficiencies were noted were also analyzed.

The analyses did not show any calcium deficiencies in the crops from the affected areas, nor did magnesium appear to have any significant effect in causing the deficiencies studied. On the other hand, all the crops from the affected areas were lower in phosphorus content than corresponding samples from unaffected areas, but the former tended to contain more calcium than the latter. Analyses of the soil from the affected areas showed a high calcium content and an apparently adequate phosphorus content, which led to the belief that the soil phosphorus was not available for plant assimilation. There was no lack of calcium in the drinking water of the deficient areas. While the amount of rainfall had no apparent effect upon the mineral content of the grasses or forage crops, it was found that the quality of grasses in wet meadows was poor from the standpoint of their value as food for cattle. Under these conditions the better grasses were killed off and replaced by rushes, sedges, and other less valuable plants.

Injurious effects of sugar-beets and their by-products when used for feeding livestock (*Utah Sta. Bul. 209 (1929), pp. 41, 42*).—From observations of the effect of feeding beet by-products to livestock, it was concluded that

many of the ill effects noted were due to bacterial poisons forming on poorly handled feed rather than to any harmful material in the feeds themselves. The organism *Bacillus botulinus* appeared to be responsible for many of the bad effects.

Insurance against drought: Drought resistant fodders, with special reference to cactus, H. W. TURPIN and G. A. GILL (*Union So. Africa Dept. Agr. Bul. 36 (1928), pp. 62, figs. 64*).—In this publication from the Grootfontein School of Agriculture, the authors point out the value of cactus for feeding livestock during periods of extended drought. The results of some feeding trials with cattle and sheep in which it was found that cactus was a rather satisfactory feed are reported. In addition cultural details, methods of utilization, and varieties of cactus are discussed, together with the diseases and insects that affect cactus.

Inspection of commercial feedstuffs, P. H. SMITH ET AL. (*Massachusetts Sta. Control Ser. Bul. 44 (1928), pp. 28*).—The results are reported of the chemical and microscopical analyses of 1,600 samples of feeding stuffs collected for official inspection during the year ended September 1, 1928 (E. S. R., 58, p. 762).

Inspection of commercial feeding-stuffs, 1928, T. G. PHILLIPS, T. O. SMITH, and F. S. SCHLENKER (*New Hampshire Sta. Bul. 236 (1928), pp. 50*).—The usual report of guaranties and analyses of 376 samples of feeding stuffs officially inspected between December, 1927, and April, 1928 (E. S. R., 58, p. 762).

Commercial feeding stuffs, L. S. WALKER and E. F. BOYCE (*Vermont Sta. Bul. 290 (1928), pp. 38*).—The usual report of the analyses for crude protein, crude fat, and crude fiber of 1,405 samples of feeding stuffs officially collected during the month of April, 1928 (E. S. R., 59, p. 762).

Balanced livestock rations, O. S. WILLHAM (*[Oklahoma] Panhandle Sta., Panhandle Bul. 2 (1929), pp. 8–12*).—A popular discussion of the facts to be considered in balancing rations for livestock.

Livestock Day (*Ohio Sta. Circ. 8 (1928), pp. 4*).—A program for Ohio Livestock Day held at Wooster, June 1, 1928.

[Experiments with beef cattle at the Eastern Oregon Substation] (*Oregon Sta. Bien. Rpt. 1927–28, p. 130*).—The results of two experiments are noted.

Growing heifers.—Heifers bred to calve at 24 months of age produced an 80 per cent calf crop at the first and a 77 per cent crop at the second calving, while similar heifers calving for the first time at 36 months of age produced an 83 per cent calf crop. This latter group of heifers weighed 73 lbs. more in October and their calves 7 lbs. more than animals in the early calving group. Heifers wintered on roughages were as good breeders as those fed grain, and the winter feeding of grain was found to be unprofitable.

Baby beef.—Weanling calves fed for 5 months on an average of 15 lbs. of alfalfa hay and 5 to 6 lbs. of grain gained an average of 1.9 lbs. per head daily. They produced an attractive carcass of good quality at this age, but the beef had a slight veal flavor. All of the common grains have been found fit for such feeding, and the use of oil meal in addition to the alfalfa hay was found unnecessary.

Pasture studies with beef cattle, K. C. IKELER (*Utah Sta. Bul. 209 (1929), p. 42*).—The results of 1 year's study indicate that a 6-acre irrigated pasture divided in equal parts on which 4 cows and their calves are rotated every 2 weeks produces larger gains than a similar pasture not divided or rotated and carrying a like number of cattle.

[Experiments with sheep and goats at the Oregon Station] (*Oregon Sta. Bien. Rpt. 1927–28, pp. 50, 51, 52, 117*).—Continuing these studies (E. S. R., 60, p. 762) several experiments are noted.

[*Pasture investigations*].—A summary of the number of trials and the number of sheep days per acre for permanent, cultivated, and irrigated pastures, for winter and spring grazing of hay crops, and for stubble pastures is given in tabular form. The average results of four years' work have shown that an acre of drilled rape produced 182 sheep days of grazing, rape and clover 283 sheep days of pasture, and clover 343 sheep days of grazing in addition to yielding 1.4 tons of hay. The drilled rape in addition to the sheep grazing replaced 493 lbs. of grain as pasture for hogs.

In 1926 grazing Hungarian vetch to the extent of 129 sheep days per acre from March 12 to 19 increased slightly the yield of hay, while another lot grazed at the rate of 259 sheep days per acre from March 12 to April 20 reduced the yield beyond the value of the pasturage. In 1927, 172 sheep days per acre as late as May 8 did not reduce the yield.

Irrigated pastures gave an average of 1,033 sheep days per acre in 1926 and 1,078 sheep days per acre in 1927.

Clearing brush land with goats.—New sprouts continued to grow on the slashed areas even after four years of grazing with goats. However, the number of new sprouts were materially reduced. On the unslashed areas the stand of brush has been markedly thinned and fir seedlings seemed to have been entirely killed out. Browsing Scotch broom has killed only an occasional plant.

Water consumption of sheep and goats.—Lambs 8 to 10 months of age drank 2.5 lbs. of water per head, or 2.96 lbs. per 100 lbs. of live weight, on a submaintenance ration, and 5.3 lbs. per head, or 4.26 lbs. per 100 lbs. of live weight, when full fed. For lambs and kids the water consumption per 100 lbs. of live weight is approximately the same.

Lamb feeding [*at the Umatilla Substation*].—For lambs being fattened for the late winter market, three years' results showed that it was profitable to cut and grind alfalfa hay when supplemented with 1 lb. of barley per head per day. While lambs gained but little on alfalfa pasture in the fall, this practice was profitable for holding the lambs to be fattened for the late market.

Shall growing pigs be full fed? E. F. Ferrin and M. A. McCarty (*Minnesota Sta. Bul. 248 (1928), pp. 14, fig. 1*).—In this study a comparison was made of full and limited feeding of grain as economical methods of producing market hogs. The experiment was continued for 2 years with conditions duplicated as nearly as possible. Four lots of 10 pigs each were fed each year on a ration of shelled corn, standard middlings, tankage, and minerals. Lots 1 and 2 were fed in dry lot, while lots 3 and 4 were run on alfalfa pasture. Lots 2 and 4 received a half feed of grain for 90 days and were then full fed new corn and tankage. All lots were carried until the pigs reached an average final weight of 200 lbs.

The full-fed pigs reached the market weight in an average of 46 days less than pigs on the limited ration. In the dry lot feeding, there was an average saving of approximately 75 lbs. of feed per 100 lbs. of gain in favor of the full feeding and an average saving of about 48 lbs. of feed for the lots full fed on alfalfa pasture. The cost of feed per 100 lbs. of gain was approximately the same for the two methods, but the labor cost of feeding was 44 cts. less per head in the full-fed groups. Full feeding prepared the pigs for an earlier and higher market, and they therefore sold at a higher price per pound and returned a greater margin over feed cost than the limited-fed pigs.

[**Experiments with swine at the Oregon Station**] (*Oregon Sta. Bien. Rpt. 1927–28, pp. 49, 50, 131*).—The results of several experiments in continuation of those previously noted (E. S. R., 60, p. 765) are reported.

Pasture for pigs.—An acre of rape pasture during the dry season of 1926 saved 386 lbs. of grain, while in 1927, a favorable season, 1 acre replaced 2,213 lbs. of grain for fattening pigs.

Fineness of grinding grain for pigs.—Results of 4 tests showed that grain ground in a hammer mill with a ¼-in. screen was 11.24 per cent more efficient than whole grain and that grain ground in a mill with a $\frac{3}{32}$-in. screen was 17.72 per cent more efficient. Steamed-rolled grain was worth 17.93 per cent more than whole grain, but soaking whole grain reduced its value 4.34 per cent for swine.

Methods of growing pigs.—In four studies, pigs fed to 100 lbs. in weight on oats have gained practically as much as those fed barley. During the fattening period on barley the pigs grown on oats have made more rapid and economical gains than those fed barley from the start.

Protein and vitamin deficiencies of barley and tankage for pigs.—Rape pasture has increased the gains produced by a barley and tankage ration more than could be accounted for by the nutrients in the rape. Alfalfa meal also increased the gains obtained with this ration for pigs not on pasture and usually reduced the percentage of rickets which often occurred. Substituting oil meal for part of the tankage or adding cod-liver oil to a barley, tankage, and alfalfa meal ration has given negative results.

[*Swine feeding at the Eastern Oregon Substation*].—A study of supplements for barley and alfalfa pasture has shown that a mineral mixture is practicable and that tankage or skim milk produces slight additional gains. Maximum gains, however, were obtained with pigs fed barley, minerals, tankage, and sk m milk in dry lot.

[Feeding experiments with swine at the South Dakota Station] (*South Dakota Sta. Rpt. 1928, pp. 9, 10–12*).—The results of four experiments, some of which have been previously noted (E. S. R., 58, p. 765), are reported.

How soybeans can be fed to avoid soft pork.—Preliminary results indicate that pigs fed as small an amount as 5 per cent of soybeans with corn in dry lot may produce soft pork. A ration of corn and 15 per cent of soybeans self-fed plus a suitable mineral mixture proved inadequate for supporting satisfactory growth for pigs in dry lot.

Summer feeding pigs for market.—In this study it was found that locally grown barley had approximately 80 per cent of the feed value of a good grade of Iowa-grown corn. A ration of ground barley and a mixture of tankage and linseed meal 2:1 self-fed did not produce as rapid or as economical gains as ground barley and tankage. A limited ration of ground barley and tankage 92:8 during a 97-day growing period followed by ground barley and tankage self-fed for 58 days was more economical in the amount of feed required per pound of gain than ground barley and tankage self-fed from the beginning. Barley and tankage proved as satisfactory a growing ration as oats and barley.

Winter feeding fall pigs.—Locally grown corn and barley were found to have approximately the same feeding value in this study. A ration of corn and tankage self-fed plus alfalfa hay produced more rapid and economical gains than corn and a mixture of tankage and linseed meal 2:1 self-fed plus alfalfa hay. With barley, however, the value of the two supplements was approximately the same.

Winter rations for brood sows.—In this study 4 groups of 9 sows each were fed the following rations: Lot 1 corn, tankage, and alfalfa hay, lot 2 ground oats and alfalfa hay, lot 3 ground barley and ground oats equal parts and alfalfa hay, and lot 4 ground barley, tankage, and alfalfa hay. In lot 1, 2 sows farrowed weak pigs, all of which died soon after birth. The other sows farrowed

strong pigs and raised a fair percentage of them. Of the litters farrowed in lot 2, 1 was entirely hairless, and some pigs in 2 other litters were hairless. The other pigs grew well until about 3 weeks old when they began to lose weight, and mortality was heavy after this period. One sow in lot 3 farrowed 2 hairless pigs. The other pigs in this lot grew well to 3 weeks of age, after which losses occurred, although they were not so heavy as in lot 2. Pigs from 2 litters in lot 4 were lost in the same manner as in the two preceding lots, but the other pigs grew fairly well.

A review of some important papers published during the year, C. S. Platt (*New Jersey Stas. Hints to Poultrymen, 17 (1928), No. 2, pp. 4, fig. 1*).—A summary of some of the papers published in *Poultry Science* during the year 1928, some of which are noted elsewhere in this issue and others have been previously noted (E. S. R., 59, p. 870; 60, pp. 566, 567, 580).

Ohio Poultry Days (*Ohio Sta. Circ. 11 (1928), pp. 16, figs. 6*).—The results of four experiments, all of which have been previously reported (E. S. R., 58, p. 669; 60, p. 468), are briefly noted in this publication.

Ohio Poultry Day (*Ohio Sta. Circs. 3 (1926), pp. 4; 6 (1927), pp. 4, fig. 1*).—The programs for Ohio Poultry Day held at Wooster, Ohio, June 18, 1926, and June 17, 1927, are given.

[Experiments with poultry at the South Dakota Station] (*South Dakota Sta. Rpt. 1928, pp. 26, 27–29*).—The results of several experiments in continuation of those previously noted (E. S. R., 58, p. 766) are reported.

Artificial lighting.—Pullets in lighted pens had a production percentage of 49 as compared with 30 for pullets in unlighted pens. While consumption of mash was higher in the lighted pens, the cost of feed per dozen eggs was lower than in unlighted pens. The lights had no apparent ill effects on pullets as breeders or layers in later years.

Feeding all mash ration.—Birds fed an all-mash ration had a 50 per cent egg production as compared with a 58 per cent production for a lot fed scratch and mash. The feed consumption was less and the cost per dozen eggs higher in the all-mash lot. However, this method of feeding gave good results and was economical in amount of time and labor required, and mortality with this method for chicks was lower. After 6 to 8 weeks of feeding young stock, a scratch and mash ration seemed to be more convenient and successful.

Poultry mineral supply.—A comparison of the preferences of birds for various calcium-bearing substances showed that dolomitic limestone ranked first, that oyster shells were more readily consumed than clam shells, and that ground raw rock phosphate had little or no appeal for the birds. Chemical analysis showed that the lime rock contained approximately the same amount of calcium carbonate as oyster shells. The source of minerals had a marked effect on the composition of egg shells, birds receiving magnesium limestone laying eggs with a higher percentage of magnesium in the shell than those in other lots.

High protein feeds.—A study of the economy of various protein supplements based on the feed cost per dozen eggs was determined with 8 pens of 30 birds each and fed the same basal ration. The supplements ranged in the following order in economy: Tankage plus buttermilk powder, meat scrap, tankage, buttermilk powder, ground soybeans, buttermilk powder plus tankage, cottonseed meal, and soybean meal. No differences in the shell character and density, color, and consistency of yolk and white, and effect on cooking, odor, and flavor were noted in the various lots.

Alfalfa for poultry.—It was found that alfalfa meal could replace either the bran or the middlings in a ration without affecting the production, but when used to replace both, production fell off badly. Home-ground alfalfa chaff gave

as good results as and was more economical than commercial meal. Steamed or soaked chaff mixed with grains made a fair substitute for green feed.

Turning hatching eggs.—In this study a lot of eggs not turned during the incubation period hatched 46 per cent, but many of the chicks were small and not clean and fluffy. Another lot turned for the first 12 days hatched 57 per cent of fairly satisfactory chicks, while a third lot turned the first 18 days hatched 71 per cent, and all the chicks were plump and fluffy.

[Poultry experiments at the Utah Station], B. ALDER (*Utah Sta. Bul. 209 (1929), pp. 37, 38*).—Progress reports of two experiments are noted (E. S. R., 52, p. 773).

Breeding for egg production.—In this study a Leghorn hen has finished 4 years' production with a record of 870 eggs. At the same time her dam finished her seventh year's production with a record of 1,271 eggs.

Poultry feeding.—Calcium carbonate limestone containing little or no magnesium was found to be practically equal to oyster shell as a source of calcium carbonate in the poultry ration.

Skim milk and dried milk were of equal value as supplements for meat meal in the laying mash. No better results were obtained when dried milk replaced three-fourths of the meat meal than when it replaced only one-fourth of the meal.

Experiments in poultry raising at Ben-Shemen (first report), D. URI (*Zion. Organ. Agr. Expt. Sta. Bul. 5 (1927), pp. [2]+55, pls. 4, figs. 4*).—Preliminary results of experiments in breeding, feeding, management, diseases, and construction of poultry houses at Ben-Shemen, Palestine, are reported.

Growth values of proteins from commercial animal products.—III, A commercial meat meal, R. W. PRANGE, C. W. CARRICK, and S. M. HAUGE (*Poultry Sci., 7 (1928), No. 5, pp. 233–238, figs. 2*).—A study of the growth value of the proteins of a certain meat meal (E. S. R., 50, p. 164) for young chicks at the Indiana Experiment Station, using crossbred chicks in one trial and Barred Plymouth Rocks in a second, is reported in this paper. The plan of the experiment was the same as for those previously noted (E. S. R., 59, p. 861), the meat meal being fed at 15, 10, and 5 per cent levels of protein to different lots of chicks. These lots were compared with a lot receiving 10 per cent of protein from meat and bone scraps.

Satisfactory growth was not obtained with the meat meal even when fed to supply 15 per cent of protein to the ration. However, no harmful effects to young chicks that could be attributed to the meat meal were observed even when fed in large amounts.

The anti-rachitic value of cod liver meal, F. E. MUSSEHL, R. HILL, and C. W. ACKERSON (*Poultry Sci., 7 (1928), No. 5, pp. 239–242, figs. 2*).—A basal ration which produces good growth when supplemented with vitamin D or direct sunlight was fed to 3 lots of 40 7-day-old chicks each at the Nebraska Experiment Station. To the basal ration in lot 1 was added 2 per cent of cod-liver meal and in lot 2 2 per cent of cod-liver oil. In a period of 8 weeks lot 1 increased from an average of about 50 gm. per head to about 425 gm. and 19 of the chicks died. Lot 2 increased from the same initial weight to about 550 gm. and only 2 chicks died, while in lot 3 the chicks grew to about 310 gm. and 25 chicks died.

In further studies a lot of 80 chicks fed a ratiton supplemented with 5 per cent of cod-liver meal increased from an average initial weight of 50 gm. to an average final weight of 300 gm. in 8 weeks and 6 chicks died. A similar lot whose ration was supplemented with 2 per cent of cod-liver oil increased to about 475 gm. per head and 5 chicks died. Of the 74 remaining chicks in

the first lot 39 showed unmistakable signs of rickets, while only 3 of the 75 in the second lot had rickets.

From the above data it was concluded that while cod-liver meal contains some vitamin D, even 5 per cent does not furnish enough of this factor to prevent rickets with a ration complete in every other respect.

The anti-rachitic value of salmon oil, D. E. Davis and J. R. Beach (*Poultry Sci., 7 (1928), No. 5, pp. 216–218*).—In a study at the California Experiment Station (E. S. R., 57, p. 270), 2 lots of 25 3-day-old chicks each were fed the same basal ration to 12 weeks of age. Lot 1 had 2 per cent of salmon oil added to the ration, while lot 2 received the basal ration only. Up to 6 weeks of age there was no evidence of leg weakness in either group, but the birds in lot 1 averaged 266.6 gm. in weight, while those in lot 2 averaged 233.3 gm. Symptoms of leg weakness began to appear in lot 2 at about the seventh week, and the number of birds showing these symptoms gradually increased. At 12 weeks of age all the birds in both groups were killed for post-mortem examination, and at this time 95.6 per cent of lot 2 showed unmistakable signs of rickets, while no such symptoms were manifest in lot 1. The average weight per bird at 12 weeks was 679 gm. for lot 1 and 452.5 gm. for lot 2. These results indicate that the salmon oil used, which was extracted from cannery refuse containing a considerable amount of viscera, was a good source of the antirachitic vitamin.

Preferential mating of fowls, C. W. Upp (*Poultry Sci., 7 (1928), No. 5, pp. 225–232*).—In this study at the Oklahoma Experiment Station the mating activities of fowls were observed with 2 lots consisting of 1 cockerel and 15 pullets each. Observations in the first test were made April 15, 17, and 19, while in the second test the observations were made for 16 consecutive days from June 16 to July 1, inclusive. The males were removed from the flock each night and replaced in the morning at about 6 o'clock.

With the exception of 1 bird in the first test each female was mated with at some time during the period of observation. In the second trial 1 bird was mated with only 4 times, while a second was mated with 59 times during the period. The average number of copulations per bird per day was 1.46 and 1.15 in the respective trials. It was observed that the period of greatest sexual activity of the male birds was from 3 p. m. to the time when the birds went to roost, in the first test 60 per cent and in the second 44.2 per cent of the copulations occurring at this time. Sexual activity was noticeably decreased on very warm days. No apparent relationship was found to exist between egg production for several preceding months and the number of copulations.

Studies in hatchability.—I, Hatchability in relation to antecedent egg production, fertility, and chick mortality, M. A. Jull (*Poultry Sci., 7 (1928), No. 5, pp. 195–215*).—After reviewing the literature the author reports results of studies on the relationship between hatchability and antecedent egg production and between fertility and chick mortality. The analyses were made from the hatching and chick mortality records of the breeding flocks of Barred Plymouth Rocks, Rhode Island Reds, and White Leghorns at the U. S. Animal Husbandry Experiment Farm, Beltsville, Md., for the years 1925, 1926, and 1927. These records are from 543 individual matings, from which 13,552 fertile eggs were incubated, 9,783 chicks hatched, and 8,980 chicks raised to 4 weeks of age. Hatchability was 72.19 per cent of the fertile eggs, embryo mortality 27.81 per cent (of which 30.17 per cent occurred up to the seventeenth day and 69.83 per cent during the last 3 days of incubation), and chick mortality 8.21 per cent up to 4 weeks of age.

The analyses have not shown that antecedent egg production affects hatchability or chick mortality up to 4 weeks of age, nor was any correlation found to exist between fertility and hatchability. The causal factors that affect hatchability did not significantly affect chick mortality. No relationship was found between factors affecting embryo mortality up to the seventeenth day or for the last 3 days of incubation and chick mortality up to 4 weeks of age.

When should chicks be given first feed? R. E. ROBERTS (*Poultry Sci.*, 7 (1928), No. 5, pp. 220–224).—In a series of 3 tests at the Indiana Experiment Station 2 lots of chicks were compared to ascertain the effect of immediate feeding after placing in the brooder and of withholding feed for 44 to 48 hours. The same ration was fed to both groups in each series.

The rate of growth was approximately the same up to the seventh or eighth week of age with either method of feeding, and mortality was quite low in all groups. While this study does not show any harmful effects, especially digestive disorders, due to early feeding, it shows that early feeding has no advantage over withholding feed for 48 hours.

DAIRY FARMING—DAIRYING

Effect of fluorine in dairy cattle ration, G. E. TAYLOR (*Michigan Sta. Quart. Bul., 11 (1929), No. 3, pp. 101–104, figs. 2*).—In the study of raw rock phosphate (E. S. R., 59, p. 571) the results obtained led to the belief that the fluorine content might be the detrimental factor. To test this out two animals were fed calcium fluosilicate beginning July 27, 1926. One received 0.125 per cent fluorine on a dry matter basis and the other twice this amount. Both went off feed immediately and ate but little grain or hay for 3 weeks. On August 17 one animal was removed and the fluorine in the other ration reduced to 0.4 gm. daily and then gradually increased to 5 gm. daily. When held in this manner the animal consumed all of her feed. After December 10 the fluorine content of her ration was equal to the amount present in a ration containing 1.5 per cent of rock phosphate, and up to her first lactation she remained apparently normal in health and general appearance. Just before freshening, however, the animal suffered from slight digestive disturbances and went off feed occasionally for short periods. After freshening she began to lose weight rapidly and her appetite was poor. At the end of the lactation period she was quite emaciated, in poor condition, and the grinding surfaces of her molars were worn so that they were sensitive to cold water.

On January 12, 1928, two 4-months-old heifer calves were fed a basal ration of skim milk, corn, oats, alfalfa hay, and 50 gm. of steamed bone meal daily. One animal received in addition 1.5 gm. of calcium fluosilicate. After the second day on this ration the grain was refused, and the animal lost weight, her coat became rough, and considerable irritability was noticed. At 10 months of age the skim milk was discontinued and bone flour replaced the bone meal. On August 4 the rations of the two animals were reversed. The calf that had been receiving fluorine showed marked improvement at once. The other animal, which had been growing normally to this time, went off feed and began to lose flesh and condition immediately.

[Experiments with dairy cattle at the Oregon Station] (*Oregon Sta. Bien. Rpt. 1927–28, pp. 54, 55, 79*).—The results of several experiments in continuation of those previously noted (E. S. R., 60, p. 769) are reported.

Mineral requirement of growing heifers.—Groups of heifers fed either alfalfa hay, cheat hay, and later oat hay, cheat and oat hay plus a mineral supplement of steamed bone flour, or oat hay plus steamed bone flour and cod-liver oil

seemed to grow normally. In practically all animals the breeding data indicated abnormal conditions, but this condition was not any more pronounced in one lot than in another.

Metabolism experiments [and] biological value of alfalfa proteins.—In 12 balanced periods it was found that cows producing a moderate amount of milk on rations made up chiefly of alfalfa hay showed a positive calcium balance, a negative phosphorus, and frequently a negative nitrogen balance. Adding disodium phosphate to the ration brought about a positive phosphorus balance. The nitrogen balance seemed to depend upon the quality of the hay.

Using rats in a preliminary study of the biological value of alfalfa protein, growth curves obtained from the addition of small amounts of cystine to a ration in which alfalfa was the sole source of protein indicated an incompleteness of this amino acid in alfalfa.

[Experiments with dairy cattle at the South Dakota Station] (*South Dakota Sta. Rpt. 1928, pp. 12–14*).—The results of experiments, several of which have been continued (E. S. R., 58, p. 769), are reported.

Sweetclover pasture v. alfalfa pasture for dairy cows.—From June 3 to September 8, 2 lots of 8 cows each were pastured on 5-acre lots of alfalfa and sweetclover. Grain was fed according to milk production. During this period the cows on alfalfa lost a total of 137 lbs. and those on sweetclover 647 lbs. The alfalfa cows produced on the average approximately 3,141 lbs. of milk and 117.4 lbs of fat, while the sweetclover cows averaged 3,034 lbs. of milk and 109.9 lbs. of fat for the period. No cases of bloat occurred during the test.

Digestibility of corn husks.—On an air-dry basis, corn husks showed the following analysis: Moisture 4.92, protein 6, ether extract 1.22, ash 4.63, crude fiber 33.28, and nitrogen-free extract 49.95. A digestion trial indicated that corn husks did not contain enough nutrients for maintenance.

Grinding of roughage for dairy cows.—The results of 3 trials with alfalfa, sweetclover, and corn stover indicate that grinding roughages increases the cost of milk production from 3 to 11 per cent per 100 lbs. of milk and decreases the digestibility of the entire ration. Cows refused 36 per cent of the corn fodder, but cut stover was eaten more readily than whole stover. There was a slight increase in milk when ground or cut forages were fed.

Effect of sunshine on growth of dairy calves.—Preliminary studies with 2 lots of 4 calves each fed the same ration showed no physical differences when 1 lot was exposed to sunlight and the other confined in a shed and not exposed to the sun's rays.

Dairy work (*Ohio Sta. Circ. 13 (1928), pp. 24, figs. 10*).—Brief summaries of experiments completed and of those in progress, most of which have been noted elsewhere, are presented in this publication.

Dairy Day (*Ohio Sta. Circ. 12 (1928), pp. 4, figs. 2*).—A program for Ohio Dairy Day held at Wooster, August 24, 1928.

Sudan versus native grass, 1928, O. S. Willham (*[Oklahoma] Panhandle Sta., Panhandle Bul. 3 (1929), pp. 3–5*).—A 10-acre plat of native grass, mixed Buffalo and grama grasses, put 7.68 lbs. of gain per acre on Holstein heifers from July 8 to October 1, while a 5-acre field of Sudan grass put 141.68 lbs. of gain per acre on two heifers on the pasture for 86 days and an additional two heifers for 64 days. During the month of August the heifers on native grass lost a total of 35 lbs., while two heifers on Sudan grass gained 80 lbs. The condition of the heifers on Sudan grass at the end of the test was much better than that of the heifers on native pasture.

Ground hay for milk production, K. S. Morrow and J. P. LaMaster (*South Carolina Sta. Bul. 255 (1929), pp. 31*).—This is a more detailed account of work previously noted (E. S. R., 60, p. 770).

Corn silage versus sweet sorghum silage for milk production, J. P. LaMaster and K. S. Morrow (*South Carolina Sta. Bul. 254 (1929), pp. 32, figs. 2*).—A more detailed account of work previously noted (E. S. R., 60, p. 770).

Effect of turnips on quality of milk and butter (*Oregon Sta. Bien. Rpt. 1927–28, p. 54*).—In this study it was found that while feeding turnips, especially those that have begun to rot, previous to milking may produce objectionable flavors, feeding after milking even in excessive amounts does not produce off-flavors in butter.

Raising dairy calves and heifers, J. V. Hopkins and H. O. Henderson (*West Virginia Sta. Circ. 52 (1928), pp. 23, figs. 8*).—In this publication the authors present in a popular manner the procedures to follow for successfully and economically raising dairy calves and heifers. Brief discussions are given of some of the common calf ailments and of practices for fitting and showing such animals.

Starting a purebred herd, J. K. Muse (*[Oklahoma] Panhandle Sta., Panhandle Bul. 2 (1929), pp. 12, 13*).—A popular discussion of three methods of starting a dairy herd, with the advantages and disadvantages of each.

Comparison of filterer vs. clarifier for market milk (*South Dakota Sta. Rpt. 1928, pp. 14, 15*).—Continuing this study (E. S. R., 56, p. 673), it was found that a filter was more economical than a clarifier when initial cost, labor of caring for machine, and depreciation are considered. Clarifiers remove more material from milk than filters, and the second clarification of a sample of milk removed 43 per cent as much material as the first. The clarifier removes material equal to 0.41 per cent of the total solids of milk. In this material were found 3.51 per cent protein, 4.81 per cent fat, and 8.5 per cent ash. The filter removed 0.1 per cent of the total solids of milk, which contained 4.32 per cent protein, 31.2 per cent fat, and 6.19 per cent ash. Milk which had been filtered had a cream line of from 1 to 3 per cent hetter than milk that had been clarified. Clarified milk had a higher percentage of bacteria and was reduced by methylene blue in less time than filtered milk. When the milk was of high quality the filter was more efficient than the clarifier.

Why cream tests vary, J. K. Muse (*[Oklahoma] Panhandle Sta., Panhandle Bul. 3 (1929), pp. 6–9*).—In this article the author enumerates and discusses some of the principal causes for the variation in cream tests.

Essentials for the successful operation of a local creamery, W. White (*U. S. Dept. Agr., Misc. Pub. 37 (1928), pp. 12, figs. 3*).—The author points out in this publication such factors to be considered in establishing a local creamery as volume of cream as it affects manufacturing costs, number of cows available as a source of supply, the territory to be covered, location of plant, the need of efficient operation, the need of a well-planned building and of sanitary surroundings, the list of necessary equipment, and the legal requirements that must be complied with.

Points to consider in establishing a cheese factory, H. L. Wilson (*U. S. Dept. Agr., Misc. Pub. 42 (1928), pp. 10, figs. 4*).—This publication was prepared to answer questions regarding the conditions under which cheese can be made, the total investment required, the necessary equipment, and the approximate price which a cheese factory can pay for milk, etc.

Vanilla flavors do not freeze out of ice cream, P. S. Lucas and A. C. Merrill (*Michigan Sta. Quart. Bul., 11 (1929), No. 3, pp. 118–120*).—Vanilla flavors of 8 varying types were added in proper amounts to ice cream mixes of the same composition, the mixes frozen in identical manner, and samples taken and held in storage. A week later a second series of mixes were frozen and the previous week's samples scored against the fresh samples to detect

a diminution in the strength of the flavor due to storage. This procedure was repeated until 12 series had been scored at the end of a week, a month, and a 3-month storage period.

No loss in strength of flavor could be detected by scores after any period of storage, and this was true whether single strength extracts or those reenforced with coumarin or vanillin were used. Flavors obtained by the use of single-strength extracts from all Mexican beans scored highest. Extracts aerated for 8 hours at 32° F. produced as good flavor as nonaerated extracts. Slight melting and refreezing of ice cream caused so little volatilization of the flavoring extract that the loss could not be detected by taste. It was concluded that vanilla used in any of its liquid forms in ice cream is very stable and does not tend to disappear during the storage period.

VETERINARY MEDICINE

[Report of work with livestock diseases] (*Oregon Sta. Bien. Rpt. 1927–28, pp. 52, 58–61*).—In a comparison of treatments for foot rot in goats, copper sulfate and formaldehyde were quite effective and butter of antimony and gasoline quite ineffective. The work shows that a mixture of 1 part of copper sulfate, 2 parts of lysol, and 2 parts of vaseline is exceedingly effective in treating the disease.

It is pointed out that (1) the experimental production of immunity to avian coccidiosis, (2) the discovery of a satisfactory method of immunizing poultry against chicken pox, and (3) the success of field experiments in the control and eradication of infectious abortion are outstanding accomplishments in work by the department of veterinary medicine. In work on the manner of spread of infectious abortion, negative reacting bulls mated with reacting cows continued to fail to spread the infection when later bred to negative cows and heifers. In the work of establishing abortion-free from abortion-infected herds, cooperative experiments under way in 15 counties have given good results in nearly every herd. The spread of abortion has been prevented by removing infected animals from barns and cleaning and disinfecting the barns, as shown by the housing of abortion-free cattle therein.

Reference is made to a study of sterility in bulls (E. S. R., 60, p. 773).

Under the heading of parasitic diseases of sheep and goats an account is given of work with liver flukes, lungworms, and stomach worms. The eggs of liver flukes kept in water at room temperature commenced to hatch in 21 days and continued to hatch for 120 days. Freezing at 8° F. for 24 hours failed to prevent the hatching of eggs that had not embryonated, while embryonated eggs failed to hatch after such freezing. No miracidia were ever observed to live more than 8 hours after hatching from the egg. Of the six species of snails of the genus Lymnaea one was identified as *L. truncatula*, a species which acts as a secondary host of the liver fluke in Europe. Three different cercaria, or immature flukes, were observed in the snails, one being very similar to the cercaria of the liver fluke. In autopsy examinations immature flukes were observed as early as July and as late as February and mature flukes from July until March.

In work with lungworms the larvae were not destroyed by freezing for 5 days, thawing, and freezing for an additional 5 days. It is said that worms representing Ostertagia, Trichostrongylus, and Nematodirus are present in nearly every sheep and goat in western Oregon, but that *Hemonchus contortus* has not been found in the State. In control work tetrachlorethylene has given good results in field trials, but copper sulfate has not proved satisfactory.

Continued studies of salmon poisoning of dogs (E. S. R., 60, p. 773) have shown the fresh water snail, *Goniobasis plicifera silicula* (Gould), to be the molluscan host of the fluke *Nanophyes salmincola* Chapin, which causes it.

Experiments with coccidiosis of poultry have proved that (1) small doses of coccidia do not necessarily produce symptoms in susceptible birds, (2) repeated small doses produce a very high resistance, and (3) such resistance can be regularly produced through the regular administration of sublethal doses of coccidia. It is pointed out that there are two strains of coccidia affecting fowls, one attacking the ceca only and the other the small intestine only, and that immunity to one does not necessarily protect against the other.

Data accumulated have continued to indicate that the agglutination test is a satisfactory method of diagnosis for bacillary white diarrhea of poultry.

The vaccination of young fowls against chicken pox, in which nonattenuated virus was used, as previously noted (E. S. R., 58, p. 179), produced an immunity in 4 weeks or less which lasted for at least 2 years in some fowls. Approximately 60,000 birds are said to have been vaccinated by this method.

Miscellaneous veterinary science investigations, H. J. Frederick (*Utah Sta. Bul. 209 (1929), pp. 42–44*).—Reference is made to the occurrence of skin lesions in dairy cattle reacting to the tuberculin test, most of the 255 animals tested in Cache County having on post-mortem examination shown only skin lesions. Negative results have been obtained in the attempted transmission of infection from skin lesions in condemned cows to cattle, sheep, or pigs.

Botulism among horses was further investigated and the botulism antitoxin applied with fairly good results.

In work with progressive pneumonia, or lunger disease, in sheep, it was found impossible to transmit the disease from affected to healthy sheep either through inoculation or contact. The work conducted indicates that it is not infectious, but is contracted by sheep through rough handling. In a further study of preparturient paralysis in sheep, it was found that a reduction of feed and enforced exercise largely eliminated the trouble.

Work with poisonous plants on the range was continued (E. S. R., 56, p. 571).

[Diseases of domestic animals and their control in South Africa] (*So. African Jour. Sci., 25 (1928), pp. 246–252, 258–294, pl. 1, figs. 2*).—The contributions here presented are as follows: The Rapid Agglutination Test in the Diagnosis of Paratyphoid Infection in Calves, by E. M. Robinson and D. A. Lawrence (pp. 246–249); The Occurrence of *Salmonella aertrycke* Infection of Canaries in South Africa, by G. Martinaglia (pp. 250–252); *Papilloma tuberosum*, by P. J. J. Fourie (pp. 258–260); A Note on the Adhesion Reaction in Trypanosomiasis, by E. M. Robinson (pp. 261–264); Experimental *Trypanosoma vivax* Disease in Sheep and Goats in South Africa, by H. H. Curson (pp. 265–267); The Cultivation of *Crithidia melophagia* from the Blood of South African Sheep, by E. M. Robinson and J. G. Bekker (pp. 268, 269); Fat Necrosis in Sheep (pp. 270–273) and A Further Note on Domsiekte, or Fatty Infiltration of the Liver in Pregnant Ewes (pp. 274–277), both by G. de Kock; Several Cases of So-called Bent-leg in Sheep, by A. D. Thomas (pp. 278–281); Observations on Immunity in East Coast Fever (pp. 282–287) and A Note on the Longevity of the Brown Tick *Rhipicephalus appendiculatus* (pp. 288–290), both by P. J. du Toit; and Gross Cysticercus Invasion of the Liver in Lambs (Hepatitis Cysticercosa) (pp. 291–293), and Emphysema of the Rumen in a Sheep (p. 294), both by A. D. Thomas.

Report of the proceedings of the thirty-second annual meeting of the United States Live Stock Sanitary Association (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 4, pp. 409–694, figs. 3*).—The papers presented at the thirty-second

annual meeting of this association (E. S. R., 59, p. 169), held at Chicago December 5–7, 1928, many of which were given in connection with seven symposia held, are as follows:

Post-vaccination Trouble—A Possible Diagnostic Method, by E. A. Cahill (pp. 425–431); Standardization of Bacillary White Diarrhea Control Methods in New England, by W. R. Hinshaw (pp. 434–438); The Result of Three Years' Work in White Diarrhea Infection Control in Virginia, by I. D. Wilson (pp. 439–444); Some Experiments on the control of Bacillary White Diarrhea, by L. D. Bushnell and C. A. Brandly (pp. 444–453); The Need of Accepted Scientific Standards and Rigid Adherence to Them in Pullorum Disease Control, by L. F. Rettger (pp. 453–461); A Survey of Poultry Pathology—Past, Present, Future, by H. Bunyea (pp. 461–472); The Federal Meat Inspection Service, by D. R. Gillies (pp. 476–484); Where Veterinarians and City Health Officials Meet, by H. N. Bundesen (pp. 484–486); Municipal Meat Inspection, by W. G. Hollingworth (pp. 487–497); North Carolina an Accredited Tuberculosis-Free State, by W. Moore (pp. 498–505); On Heterologous Tuberculous Infection, by L. Van Es (pp. 505–511); The Agricultural Press and the Tuberculosis Eradication Problem, by J. Thompson (pp. 512–517); Present Status of Progress of the National Cooperative Tuberculosis Eradication Campaign, by A. E. Wight (pp. 517–526); Transmissibility of Bovine Tuberculosis to the Human, by D. C. Lochead (pp. 526–547); Lesions of Tuberculosis, by M. Pinner (pp. 547–553); The Relation of Acid-Fast Skin Infections of Cattle to Bovine Tuberculosis and Other Acid-Fast Infections, by J. Traum (pp. 553–575); Tuberculosis Eradication Campaign, by A. J. Glover (pp. 576–581); A Two-Year Experiment with the "Calmette" Method of Vaccination, by W. P. Larson and W. A. Evans (pp. 581–585); Tick Eradication in Texas, by R. Kleberg (pp. 587–596); The Unfinished Work of Tick Eradication, by S. J. Horne (pp. 596–598); Organization in Connection with Tick Eradication, by R. E. Jackson (pp. 598–602); Relation of Undulant Fever in Man to Live Stock Sanitation, by V. A. Moore (pp. 605–617); Bang Disease from a Regulatory Standpoint, by T. E. Munce (pp. 622–629); Mineral Deficiencies in Swine Rations, by H. H. Mitchell (pp. 651–661); Nutritional Diseases of Swine, by G. Bohstedt (pp. 661–672); and Iron in Nutrition, by E. B. Hart (pp. 673–679).

In addition, reports of committees are given as follows: Swine Diseases, by C. Murray et al. (pp. 432, 433); Poultry Diseases, by R. Graham et al. (pp. 473–475); Meat and Milk Hygiene, by J. P. Iverson et al. (pp. 497, 498); Tick Eradication, by N. F. Williams et al. (pp. 602–604); Infectious Abortion, I, II, by W. Giltner et al. (pp. 630–649); Nutritional Diseases, by A. F. Schalk et al. (pp. 679–686); Terminology of Poultry Diseases, by R. A. Craig et al. (pp. 686, 687); Tuberculosis, by C. E. Cotton et al. (pp. 687, 688); Unification of Laws and Regulations, by W. J. Butler et al. (pp. 688, 689); Resolutions, by T. E. Munce et al. (pp. 689, 690); and Parasitic Diseases, by M. C. Hall et al. (pp. 693, 694).

Four species of range plants not poisonous to livestock, C. D. Marsh, A. B. Clawson, and G. C. Roe (*U. S. Dept. Agr., Tech. Bul. 93 (1928), pp. 10*).—This is a report upon four species of supposedly poisonous range plants studied in the experimental work on stock-poisoning plants but found nontoxic, namely, *Wyethia amplexicaulis*, commonly known as "mule ears" or "sunflower," very abundant on some of the ranges in Utah, and generally considered a good forage plant; *Apocynum ambigens* collected in Utah; *Malva parviflora*, known as cheese weed and found in Arizona and California; and *Symphoricarpos vaccinioides*, known as snowberry or buckbush.

Feeding tests with Mexican poppy and stinkwort, H. R. SEDDON and H. R. CARNE (*Agr. Gaz. N. S. Wales, 39 (1928), No. 7, pp. 527–530*).—Several weeds that are considered harmful to livestock are being tested by the New South Wales Department of Agriculture to determine the toxicity of the plants.

It was found that both the green leaves and fruiting heads of Mexican poppy (*Argemone mexicana*) are quite unpalatable to sheep, due undoubtedly to the sharp spines of the plants. Sheep fed as much as 4 lbs. of green leaves for 12 days or 1 lb. of green fruiting heads for 8 days or drenched with crude aqueous extracts of green leaves and fruiting heads remained normal. From the above results, it is concluded that well grown Mexican poppy does not exert any appreciable toxic effect upon sheep.

Similar feeding trials with stinkwort (*Inula graveolens*) also failed to show any poisonous properties in this weed as determined with sheep.

Investigations of the action of helminths on their hosts.—II, On the question of the pathological changes resulting from the migration of Ascaris larvae in the body of the host [trans. title], G. G. SMIRNOW (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 105 (1928), No. 6–8, pp. 426–444, pl. 1, figs. 6*).—This is a report on pathological changes, particularly in the liver and lungs, resulting from the migration of the Ascaris larvae in the body of the host. A list of 40 references to the literature is included.

The differentiation of Micrococcus melitensis and Bacillus abortus by chemical substances [trans. title], J. VIDAL (*Compt. Rend. Soc. Biol.* [*Paris*], *99 (1928), No. 29, pp. 1279, 1280*).—The results obtained by the author indicate that the agglutination by chemical substances is of no value in the differentiation of *B. abortus* and *M. melitensis*.

Bacillus oedematiens and symptomatic anthrax [trans. title], M. WEINBERG and M. MIHAILESCO (*Compt. Rend. Soc. Biol.* [*Paris*], *99 (1928), No. 35, pp. 1709, 1710*).—The authors review the subject and show that *B. oedematiens*, found in cases of gaseous gangrene following war wounds and more frequently met with in wounds than *Vibrion septique*, may be the single causative agent of blackleg in the bovine, as well as the ovine as shown by Turner and Davesne in Australia (E. S. R., 59, pp. 174, 275; 60, p. 179). It is considered probable that a proportion of the anaerobes isolated in symptomatic anthrax and classed as *B. chauvoei*, due to their failure to neutralize the anti-*V. septique* serum, are no other than *B. oedematiens*, and that the very virulent strains of this anaerobe produce lesions (intense hemorrhagic edema) quite similar to those caused by *V. septique*. They consider it desirable to reexamine all the strains classed as atypical *V. septique* or atypical *B. chauvoei*, since some will quite probably be found to represent *B. oedematiens*.

The influence of formaldehyde vapor on anthrax spores on the skins of dead animals [trans. title], A. F. DOROFEEV (*Trudy Sibirsk. Vet. Inst. No. 7 (1926), pp. 27–44*).—It was found that in a chamber of 295 cubic meters' capacity 7 liters of 40 per cent formalin (22.5 gm. per cubic meter) will kill anthrax spores (1) when the chamber is heated to from 50 to 60° C., (2) when the vapor is admitted into the chamber for 20 minutes under a pressure of 4 atmospheres, (3) when the chamber is saturated from 3 to 5 minutes with the above-mentioned amount of formaldehyde, or (4) when exposed to formaldehyde for a period of 40 minutes. Rarefication of the air in the chamber by use of a vacuum compressor showed no advantage from the standpoint of disinfection, but did facilitate drying of the skins and the ventilation of the chamber. Ammonia was used to neutralize the gas in the chamber, since ventilation alone is not effective for a considerable time. The skins are dried in the chamber without harmful effects.

The transmissibility, infectivity, and sensitivity of tuberculosis, A. F. Schalk (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 3, pp. 301–313*).—This is a contribution from the North Dakota Experiment Station presented at the annual meeting of the American Veterinary Medical Association held at Minneapolis, Minn., in August, 1928. The subject is dealt with under the headings of old theory upset, transmissibility studies fruitful, classical studies of Park and others, activities of the human type, the status of avian infection in cattle, typing experiments being conducted, sensitization and infection, possible sensitization without lesion infection, relationship of sensitization to the no-lesion case, sensitization experiments, and limited knowledge of virulence.

In the course of the discussion which follows the presentation, E. A. Watson reported upon examinations made of crows found dead on the shores of Lake Erie, about 15 of which were discovered to have been affected with typical tuberculosis in addition to roup. Of 20 crows caught in the vicinity of the research station at Ottawa, Canada, 3 cases of tuberculosis were detected. Work on typing the organism found in each of the crows is under way, one of which is thought to represent the bovine type.

Streptococcic mastitis [trans. title], I. M. Kramer (*Tijdschr. Diergeneesk., 56 (1929), No. 2, pp. 68–79; Ger., Eng., Fr. abs., pp. 78, 79*).—In this article the author discusses the occurrence, cause, course, diagnosis, therapeutics, and control of streptococcic mastitis, and calls attention to the great spread of the disease and the variations in types of streptococci. It is pointed out that there is considerable variation in the form of the disease, ranging from acute to chronic, and that in chronic cases no change is observed macroscopically in the udder and in the milk. Seldom or never is there a recovery so that the milk is entirely free from streptococci or leucocytes. Thus far treatment has been ineffective other than in reducing the number of bacilli in the milk. In several of the chronic cases studied, it was only at the end of the lactation period (or in other cases when milk is retained in the udder) that streptococci were found in the milk. The retention of milk seems to set up inflammation and to have a predisposing action.

The pathology of sweet clover disease in cattle, L. M. Roderick (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 3, pp. 314–326, figs. 2*).—This contribution from the North Dakota Experiment Station deals with some of the pathologic and functional features of the hemorrhagic complex which results from the feeding of damaged sweetclover hay and silage, reports upon which from this station have been noted (E. S. R., 59, p. 272).

It is pointed out that death in cattle seems to result only from hemorrhage, which is preceded by the constant development of the delay in the coagulability of the blood. No visible alteration has yet been found in the blood vessels to explain the internal hemorrhagic diathesis.

"Studies of the neutrality regulation of the animal's blood with the hydrogen electrode and the gasometric pipette showed no disturbance of that intricate mechanism. An infestation of the heart muscle of our experiment calves with *Sarcocystis blanchardi* has been an . . . almost constant incidental parasitologic finding. The absence of albuminuria and cholesterolemia, together with the normal gross and microscopic appearance of the kidneys, indicate the absence of toxic effects thereon. Focal necrosis is a common lesion in the liver. There is a question, however, if it is definitely correlated to the delay in the coagulation of the blood. Little evidence has as yet been secured to show that the function of the liver is seriously impaired. The absence of hemoglobinuria and icterus and the low icteric index, together with the failure to find deposition of hemosiderin, indicate that this is not a hemolytic disease."

Studies in infectious enteritis of swine (third paper), C. MURRAY, H. E BIESTER, P. PURWIN, and S. H. McNUTT (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 3, pp. 345–356*).—This third paper on the subject (E. S. R., 59, p. 475), which was presented at the annual meeting of the American Veterinary Medical Association held at Minneapolis, Minn., in August, 1928, deals with the subject under the headings of history, organisms found in necrotic enteritis, cultural characters of the organism, fermentation reactions, occurrence in normal swine, pathogenicity, agglutinins for *Salmonella suipestifer* in normal swine, agglutinins in infected swine, and immunity to infection. A list is given of 24 references to the literature.

Breeding diseases of the horse, W. W. DIMOCK (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 3, pp. 327–335*).—This is a contribution from the Kentucky Experiment Station presented at the annual meeting of the American Veterinary Medical Association held at Minneapolis, Minn., in August, 1928.

The treatment of experimental surra of the equine produced by Trypanosoma annamense with a mixture of sulfarsenol and 309 [trans. title], L. BROUDIN, G. LE LOUET, and A. ROMARY (*Bul. Soc. Path. Exot., 21 (1928), No. 10, pp. 849–852*).—The authors report upon cases which show that the single injection of a mixture of sulfarsenol and 309 is a most satisfactory method of treating experimental surra in the equine.

Causes of mortality of laying hens studied, H. J. STAFSETH and J. L. BOYD (*Michigan Sta. Quart. Bul., 11 (1929), No. 3, pp. 137–141*).—This report is based upon complete records of the mortality among hens kept continuously since the commencement of the international egg-laying contests at the station on November 1, 1922. From these records the authors have compiled the number of deaths for each breed and variety in addition to the yearly and monthly death rates for the 6-year period ended October 31, 1928, the details of which, with the autopsy findings, are presented in tabular form. The records are based upon 1,445 fowls, for which 1,601 cases of disease are listed. The total percentage of mortality for the 6-year period was 19.5. The records indicate that nearly one-fifth of the pullets die during their first year of egg production when placed under conditions primarily designed to promote high egg production. It was found that the greatest number of deaths occurs in March, April, and May, and the lowest in November.

A comparison of the pullorin reaction and the agglutination test for bacillary white diarrhea, L. D. BUSHNELL and C. A. BRANDLY (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 3, pp. 364–371, figs. 2*).—This is a contribution from the Kansas Experiment Station. The authors were led to conclude from the study that the pullorin test in its present status is not so satisfactory in detecting carriers of bacillary white diarrhea as is the agglutination test. Since there is a fairly high correlation between the two reactions in the same flock, it is evident that there is a possibility of developing a pullorin which will be satisfactory for the purpose. Until such a product is developed, the agglutination test should be used. The rapid, slide-agglutination test is as effective as the tube test and may be used to replace it.

Bacillary white diarrhea, K. W. NIEMANN (*North Amer. Vet., 10 (1929), No. 4, pp. 51, 52*).—This contribution from the Kansas Experiment Station reports upon the lesions found in 902 fowls received from poultrymen and veterinarians for diagnosis. The details are presented in tabular form.

Lung lesions, exclusive of pneumonia, were found to be present in nearly 44 per cent of fowls from which *Salmonella pullorum* was isolated, which tends to establish these particular lesions as characteristic, if not pathognomic, of pullorum disease in chicks. Heart lesions were found to be present in nearly

10 per cent of all fowls from which *S. pullorum* was isolated, the condition appearing to be associated more or less specifically with acute pullorum infection in chicks. Unabsorbed yolks were observed in nearly 78 per cent of chicks from which *S. pullorum* was isolated.

It is pointed out that while thousands of chicks which have died or become diseased have been examined, not a single case has been observed in which Aspergillus was the primary cause of the infection. It is concluded that a large number of cases diagnosed as aspergillosis without bacteriological examination were due to acute *S. pullorum* infection.

Regulatory work with bacillary white diarrhea, B. T. Simms (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 3, pp. 359–363*).—A contribution from the Oregon Experiment Station presented at the annual meeting of the American Veterinary Medical Association held at Minneapolis, Minn., in August, 1928, in which an outline is given of the plan adopted in 1925 and followed by the Oregon State Livestock Sanitary Board.

Pennsylvania method for the prevention, control, and eradication of Salmonella pullora infection (bacillary white diarrhea) (*North Amer. Vet., 10 (1929), No. 4, pp. 53–56*).—Details of the method of control employed in Pennsylvania are presented.

Pseudo-fowlpest, W. K. Picard (*Dutch East Indies Dept. Agr., Indus. and Com., Vet. Bul. 65 [1928], pp. 46, pls. 8*).—This is a report of studies of an epizootic disease of poultry prevailing in the Dutch East Indies and caused by a filtrable virus, for which the author proposes the name pseudo-fowlpest. The symptoms and post-mortem findings showed considerable resemblance to those of fowl plague, the mortality reaching as high as from 90 to 100 per cent. It is, however, differentiated from fowl plague by a longer period of incubation, a longer course, and noninfectivity of the blood. The virus is present in the saliva, feces, brains, and in the yolk fluid prevailing in the abdominal cavity of cadavers of laying hens. The immunity of fowls recovering from natural and artificial infection lasts at least 190 days.

Coccidiosis of the chicken, W. T. Johnson (*Oregon Sta. Bul. 238 (1928), pp. 16, figs. 7*).—This is a practical summary of information on this disease of the fowl based upon investigations conducted, earlier accounts of which have been noted (E. S. R., 57, p. 773; 58, p. 775).

AGRICULTURAL ENIGNEERING

[Agricultural engineering studies at the Oregon Station] (*Oregon Sta. Bien. Rpt. 1927–28, pp. 109–111*).—The progress of experiments on prune dehydration is reported, indicating that the use of electric fans for recirculating the air in prune driers increased the capacity of the plant, made the production of a better product possible, and enabled the operators to have more certain control of the process of drying. It was found that adding a motor-driven fan to the Oregon tunnel type of drier produced results approximately equal to the more costly driers of newer type which were being constructed. One of the oustanding results of the investigation was the discovery that prunes dry more rapidly at high initial temperatures and low finishing temperatures, and with low relative humidity at the beginning of the process and high relative humidity at the end of the drying period. These conditions are the reverse of those existing in the present type of driers.

Tests of arc lamps for lighting poultry houses as compared with Mazda lamps gave results favoring the arc lamp with reference to mortality and gain in weight. The arc-lighted fowls produced fewer eggs, but the eggshells appeared to be stronger.

Field studies of electric sterilizers for dairy utensils and of methods of electrical water heating showed that electric dairy sterilizers on the market were satisfactory for sterilizing utensils, but were not satisfactory for heating water because of the inconvenience of the system and the difficulty in keeping the equipment clean. An 18-gal. tank equipped with a 600-watt heater controlled by a time switch is proving reasonably satisfactory.

A 3-year study of chick brooding by electricity and other means showed that in general the electric brooders have proved to be satisfactory from the standpoint of the quality of chicks produced and the cost of operation. The labor of caring for the electric brooders was considerably less than for other types.

The conclusion from the experiment with feed grinders was that the small hammer type mill is the most satisfactory for general farm grinding with an electric motor.

The electric hay hoisting experiments resulted in the decision that a single drum hoist is the most feasible and economical for farm use.

[Agricultural engineering studies at the South Dakota Station] (*South Dakota Sta. Rpt. 1928, pp. 3–5*).—The progress results of the refrigeration studies showed that the average electricity used by the farm refrigerator during the 10 hottest weeks of summer was 18⅓ kw. hours or 77 kw. hours per month. The average for the 5 winter months was 9.9 per week or 43.6 kw. hours per month. A favorable location of the refrigerator in the house made a difference of 0.03 kw. hour per week.

The results indicated that in order to maintain the temperature of the box at 36.16° F., which was 7.37° below the average, it took 10 kw. hours per week more electrical energy than it would to maintain the temperature at 43.5°, which was the average. The effect of the outside weather temperature on the amount of electricity used showed an increase of 0.27 kw. hour of electricity for each increase of 1° over one week's time.

In the milk separation tests, hit and miss and throttle governed engines were compared. The results varied considerably and did not run consistently in favor of either type of engine. There was, however, a very slight advantage in favor of the throttle governed engine. Both were satisfactory and the skimming efficiency was high for both engines. Gasoline power for this purpose cost about twice that of electricity, but in either case the cost was very low and would only be about 1 ct. a day on the average farm.

[Irrigation and drainage investigations at the Utah Station] (*Utah Sta. Bul. 209 (1929), pp. 70–74*).—The progress results of studies of irrigation pumping and of flood and gravel control, by L. M. Winsor, and the relation of stream discharge to precipitation, by G. D. Clyde, are briefly reported.

In the last study it was found that the density of snow increases up to a maximum when melting begins and decreases after melting begins. The maximum is different for different years, depending quite largely upon temperature and soil moisture conditions. There is a very definite lag in time from when snow starts to melt and water appears as run-off. This lag is dependent upon temperature and moisture in soil when melting begins.

Sufficient water from snow must go into the soil to saturate it before run-off begins. Fall precipitation and the physical condition of the surface soil determine quite largely the character and extent of run-off.

The studies to date indicate a very close correlation between the snow cover on the Logan drainage and the run-off of the Logan River for the period April to September, inclusive. By measuring the snow cover at Franklin Basin, Tony Grove, and Mount Logan along the fore part of April it is possible to predict within 10 per cent what the seasonal run-off will be.

Ground water development, W. PETERSON (*Utah Sta. Bul. 209 (1929), pp. 58, 59*).—The progress results of the ground water study in Millard, Utah, and Cache Counties in Utah are briefly reported, which appear to indicate the necessity for a reduced annual pumping.

Experimental and mathematical analyses of drain tile testing and new test bearing, D. G. MILLER and J. A. WISE (*Minnesota Sta. Tech. Bul. 52 (1928), pp. 66, figs. 30*).—The results of a large number of tests of draintile of different sizes are summarized and analyzed. The tests, which were made in cooperation with the Minnesota Department of Drainage and Waters and the U. S. D. A. Bureau of Public Roads, dealt with the sand bearing, the 2-edge bearing, the 3-edge bearing, and the new Minnesota bearing. In the last the lower quadrant of the tile is embedded in sand as in the sand bearing, while the load is applied along the uppermost element of the tile through a timber, as in the 3-edge bearing.

The data indicate that the ordinary supporting strength of draintile of diameters 6 to 30 in. tested in the 3-edge bearing should be multiplied by the factor of 1.49 to reduce the test results to sand-bearing values. The ordinary supporting strength of draintile of diameters 14 to 30 in. tested in the Minnesota bearing should be multiplied by the factor 1.31 to reduce the test results to sand-bearing values. In even figures this is a strength ratio of 4/3.

Summarizing the results of the mathematical analyses presented on the basis of uniform distribution of pressure in the sand of both sand and Minnesota bearings, and assuming that the solutions of the equation for the 2-edge bearing closely approximate conditions of the 3-edge bearing, the theoretical strength ratio for the sand and 3-edge bearings is 1.89, while that for the sand and Minnesota bearings is 1.81.

The results of the mathematical analyses, as presented on the basis of parabolic distribution of pressure in the sand for both sand and Minnesota bearings, give a strength ratio for the sand and 3-edge bearings of 1.58, and for the sand and Minnesota bearings 1.54.

The results of the mathematical analyses based on a pressure distribution in both sand and Minnesota bearings most unfavorable to the tile, as determined experimentally by the use of friction strips, give a strength ratio for the sand and 3-edge bearings of 1.23, and for the sand and Minnesota bearings 1.21. The results of the mathematical analyses based on the pressure distribution in both sand and Minnesota bearings most favorable to the tile give a strength ratio for the sand and 3-edge bearings of 1.49, and for the sand and Minnesota bearings 1.45.

If the most unfavorable condition of bedding for the sand bearing be compared with the most favorable condition for the Minnesota bearing, the ratio is 1.20. If the most favorable condition of bedding for the sand bearing be compared with the most unfavorable condition for the Minnesota bearing, the strength ratio is 1.46.

Except under most favorable conditions the concentration of loading on the bottom quadrant of pipe tested in the sand bearings is somewhat greater than generally assumed, while under unfavorable conditions it may be very much greater. Bedding with loose sand containing 2.5 and 5 per cent of moisture produces the most favorable conditions, in the matter of pressure distribution, while bedding with thoroughly compacted dry sand produces the most severe. Considering all degrees of compactness of sand used in the tests, that with 5 per cent moisture gives the most consistent results. The maximum moment for pipe tested in the sand bearing may be either at the top of the pipe or at the bottom, depending upon conditions of bedding.

The conclusion is drawn that a multiplying factor of 3/2, as generally used to reduce crushing strength tests of circular pipe made in the 3-edge bearing to results on a sand-bearing basis, is closely correct. A multiplying factor of 4/3 to reduce crushing strength tests of circular pipe made in the suggested Minnesota bearing to results on a sand-bearing basis is closely correct.

It is recommended, when applying the crushing test in the A.S.T.M. standard sand bearing, or in the suggested Minnesota bearing, that the sand used contain about 5 per cent moisture, and that the sand of the lower bearing be loosened by spading immediately before placing each tile for the test. Unless due attention be given both these details, consistent test results will not be obtained in the standard sand bearing.

Progress in the study of soil hydromechanics, R. W. Trullinger (*U. S. Dept. Agr., Off. Expt. Stas., Rpt. Agr. Expt. Stas., 1927, pp. 87–96*).—An analytical survey of work done in the regulation of soil moisture to meet the requirements of growing crops is presented. The results, while more or less fragmentary and disconnected, serve to emphasize the highly complex character of soil and to indicate that water exists and functions in it under many conditions and influences which it does not encounter in the open atmosphere.

With reference to soil moisture distribution and availability the findings imply that both internal and external physical factors and phenomena strongly influence the manner of existence, movements, and functions of soil moisture. It appears that a certain amount of unfree water exists in soils more or less without regard to the total moisture conditions and wholly in addition to the free water. The evidence points to the fact that total soil surface is at least one of the main factors governing the absorptive properties of soils for moisture, and that the surfaces of the colloidal materials present are especially active in the absorption of moisture in the unfree form.

It is further pointed out that the manner of existence of moisture in soils, especially the relative proportions of free and unfree moisture, are governed in some instances and influenced in most by the mechanical composition and physical structure of the soils and by certain external factors such as temperature. Apparently the most definite indication is that the factors which largely determine manner of existence also influence the absorption and retention of moisture.

The movements of moisture in soils by evaporation, capillarity, and gravity also appear to be governed largely by the physical and mechanical properties of the soils and the colloidal phenomena therein, dealing primarily with the moisture which is available to crops. A striking indication is that the conditions favoring capillary movement may be somewhat opposed to those favoring percolation.

The conclusion is drawn that the knowledge of the mechanism of the existence, movements, and functions of moisture in soils under certain conditions, and of the influence of control and regulation measures thereon, is not sufficient to insure economy.

A list of 85 references to work bearing on the subject is included.

Terracing for moisture conservation, H. H. Finnell (*[Oklahoma] Panhandle Sta., Panhandle Bul. 2 (1929), pp. 13–16, fig. 1*).—The results of experiments at Goodwell, Okla., on the use of terracing for soil moisture conservation are briefly presented and discussed.

A study of what becomes of rainfall on the heavy type of soil at Goodwell showed that an average of only 3.58 in. of the 17.3 in. received annually soaks into the soil and becomes a part of the permanent body of soil moisture. About 5.41 in. of rain comes in such small showers that it does not add anything to

subsoil moisture, remaining in the surface mulch, and being entirely evaporated after a few days. The rest of the rainfall, 11.89 in., may be classified as moderate to excessive and does varying amounts of good as to the building up of soil moisture supplies.

A preliminary consideration of the run-off problem reveals the fact that run-off conditions vary sharply even in different parts of the same field. Very slight inequalities of slope bring about the accumulation of useless surplus water in certain low spots and the injurious lack of moisture in the best drained portions of the field.

Terracing was found to improve greatly the distribution of the moisture, and the cropping results were strongly in favor of terracing.

Public Roads, [February, 1929] (*U. S. Dept. Agr., Public Roads, 9 (1929), No. 12, pp. 225–244+[2], figs. 19*).—This number of this periodical contains the status of Federal-aid road construction as of January 31, 1929, together with the following articles: The Bradley Lane Experimental Road (pp. 225–233, 242); Qualities Required in Paving Concrete, by F. H. Jackson (pp. 234–236, 241); and Concrete in Tension, by A. N. Johnson (pp. 237–241).

A high-pressure gas-compression system, J. R. Dilley and W. L. Edwards (*U. S. Dept. Agr. Circ. 61 (1929), pp. 19, figs. 12*).—This circular describes the operation of a system for experimental work with gases at normal temperature and at pressures up to 1,500 atmospheres (22,500 lbs. per square inch). Detailed drawings of each piece of equipment are shown, permitting the complete construction of the system described. Descriptions of the apparatus, together with approximate costs of its various parts, are included.

Research in mechanical farm equipment, H. B. Walker (*U. S. Dept. Agr., Misc. Pub. 38 (1928), pp. III+43, figs. 2*).—This report presents the results of a survey of research in mechanical farm-operating equipment conducted by the Bureau of Public Roads in cooperation with the American Society of Agricultural Engineers and the National Association of Farm Equipment Manufacturers, and supplements a report by Davidson (E. S. R., 56, p. 179).

A large amount of data is presented on research work in progress in mechanical farm equipment and on the funds and personnel devoted thereto. Special attention is drawn to the organization available for work of this nature, and it is stated that the assistance of the Office of Experiment Stations in the development of comprehensive and coordinated research programs is essential for the maintenance of high standards of investigation in this work. Seven appendixes are included, giving general outlines for projects on the measurement of soil tilth and for a cooperative study in farm machinery for the Southern States, the status of projects and problems already being considered by different agencies, and data on the distribution of funds and personnel for agricultural engineering research in the United States for the year July 1, 1926, to June 30, 1927. A brief bibliography is included.

Study made of garden tractor in Michigan, E. C. Sauve (*Michigan Sta. Quart. Bul., 11 (1929), No. 3, pp. 126–129*).—The results of a study of garden tractors are briefly reported, indicating that the garden tractor is approaching the degree of satisfactory performance found in the larger farm tractor.

The husker-shredder on eastern Corn Belt farms, G. W. Collier, W. R. Humphries, and E. W. McComas (*U. S. Dept. Agr., Farmers' Bul. 1589 (1928), pp. II+21, figs. 11*).—This bulletin is based largely on information obtained cooperatively by the Division of Farm Management and Costs of the Bureau of Agricultural Economics, the Division of Agricultural Engineering of the Bureau of Public Roads, the Animal Husbandry Division of the Bureau of Animal Industry, and the agricultural experiment stations of Ohio, Michigan, Indiana,

and Illinois, concerning the experience of farmers who used husker-shredders in harvesting their 1927 corn crop.

The shredder has been found to be very effective in destroying the borers in corn fodder. Shredding is most important in districts and on farms where there is a shortage of hay and straw for roughage.

Tractors with a belt rating of 16 to 20 h. p. are commonly used in operating 4-roll and 6-roll husker-shredders, and 25 to 30 h. p. tractors are used for 8-roll machines. In corn that yields 35 bu. per acre the husking capacity varies from about 125 bu. a day for a 2-roll shredder to 500 bu. a day for the 10-roll size.

To operate a husker-shredder economically one should shred about 45 acres per season with a 2-roll size, 70 acres with the 4-roll, 90 acres with a 6-roll, 110 acres with an 8-roll, and 135 acres of corn per season with a 10-roll shredder. The stover should be tramped as little as possible in storing. The hood of the blower should be adjusted frequently so that the wet butts of the stalks and the shelled corn will not accumulate in one place.

Motor-driven green feed, root, and straw choppers, F. E. PRICE, G. W. KABLE, and F. E. FOX (*Oregon Sta. Circ. 88 (1929), pp. 8, figs. 7*).—This circular deals with the small cutters used on poultry or dairy farms for chopping kale and green alfalfa for hens and chicks, roots for hens and cows, straw for chick litter, and small quantities of hay for feeding livestock.

It was found that when a hand-power green-feed cutter is operated by a small electric motor the number of pounds cut per hour is increased approximately three times. Cutters having throats up to 10 in. may be operated by a ½ or ¾ h. p. motor. Cutters may be run at speeds up to 350 r. p. m. A very satisfactory speed for the larger hand machines is 200 to 250 r. p. m.

The power consumption for cutting kale averaged with 6 machines 0.092 kw. hour per 100 lbs., for cutting fresh alfalfa (2 machines) 0.116 kw. hour, for hay (2 machines) 0.085 kw. hour, and for roots (1 machine) (0.068 kw. hour.

Buildings and equipment for the livestock farm, F. D. CORNELL, JR. (*West Virginia Sta. Circ. 53 (1928), pp. 55, figs. 50*).—Practical information on the subject is given, together with numerous working drawings and bills of material.

New poultry equipment, D. C. KENNARD (*Ohio Sta. Spec. Circ. 14 (1928), pp. 15, figs. 10*).—Practical information on portable brooder houses, summer range shelter, mash feeders, warm-water devices, and droppings-board scraper is briefly presented.

RURAL ECONOMICS AND SOCIOLOGY

The farm real estate situation, 1927–28, E. H. WIECKING (*U. S. Dept. Agr. Circ. 60 (1928), pp. 64, figs. 5*).—This circular analyzes and discusses for the United States as a whole, the different geographic divisions, and the chief production areas and some individual States the changes in farm real estate values and farm ownership and the situation as regards farm credit and farm real estate taxes during the year 1927–28.

Tables are included showing by States and geographic divisions (1) the index numbers by years, 1912–1928, of estimated value per acre of farm real estate; (2) the number of farms per 1,000 changing ownership by different methods during the years ended March 15, 1926, 1927, and 1928; and (3) the number of bankruptcies among farmers and the percentages that such bankruptcies were of all cases in the years ended June 30, 1922 to 1927, inclusive. A graph shows the changes in estimated average value per acre of farm real estate, by geographic divisions, 1920–1928.

Other tables, graphs, and maps covering the different periods present index numbers of prices and relative purchasing power of farm products and of prices paid by farmers for different groups of commodities, wages, and taxes; gross income, by groups of commodities; net income available for capital invested in agriculture; farm returns; relation of rents to real estate values in different States; percentage of total farm real estate value represented by buildings; approximate value per acre added by successive increments of building values; number, average value, and change in value of farms of different sizes in different geographic divisions; taxes and the relation of taxes to rent per acre in several States; taxes in the different geographic divisions; the relation of land values, farm prices, and incomes and of commodity prices and land values; and other data.

The weighted average value per acre for the United States declined 2 per cent during the year beginning March 1, 1927, as compared with the previous year (E. S. R., 58, p. 285). Income recovery reached 7 per cent for the national agricultural income available for capital invested. Average operating returns showed substantial increases in four geographic divisions, a very slight increase in one division, and a decrease in one division. Farm taxes in 1927 were 258 per cent of pre-war taxes, as compared with 253 per cent in 1926. Forced sales and related defaults averaged 22.8 and voluntary sales and trades 26 per 1,000 farms for the year ended March 15, 1928, as compared with 23.3 and 28.3, respectively, for the previous year.

Factors affecting selling prices of land in the eleventh Federal farm loan district, D. Weeks (*Hilgardia [California Sta.], 3 (1929), No. 17, pp. 459–542, figs. 33*).—This study was made "to determine quantitative relationships between selling price of land and the factors that affect that selling price, with a view to working toward a basis of more rational farm appraisal, in which quantitative measurements of land qualities may, in part, take the place of rough estimates of the degree to which different land qualities affect value."

It is based chiefly on data given in applications to the Federal land bank for loans in California, Utah, Nevada, and Arizona. The analysis is divided into two phases, one the dynamic economic factors influencing the general level of land prices, and the other the factors which cause differentials in prices of dairy farms, excluding such farms as did not have almost ideal physical conditions.

In the analysis of the dynamic economic factors, tables and graphs are presented and discussed showing (1) the average prices by years, 1901–1926, of land covered by Federal farm loans in California, Arizona, and Utah, and of the land in California used for permanent crops, excluding citrus fruits, and for field crops, dairy, and livestock; (2) for 1912–1926 the U. S. Department of Agriculture farm land values of improved and unimproved lands in California; (3) the effect of weighting by value, frequency, and acreage upon time series of land prices; (4) the relations of cyclical variations in resale prices in the San Joaquin Valley and the cyclical variations in pig-iron production in the United States; (5) the trends, 1919–1926, in resale prices of land in different sections of the eleventh Federal farm loan district; (6) the number of farms changing hands monthly from January, 1918, to December, 1927, inclusive, and the relation of prices to sales per month; (7) the cyclical analyses of original and final homestead entries in the United States, 1868–1923, and of wholesale prices, 1857–1927, the relationship of wholesale prices and final homestead entries, 1877–1917, and of numbers of original entries and the percentage that became final entries, 1889–1920; and (8) the relation of land prices and agricultural prices.

Using the methods and findings of Lehenbauer regarding the growth of maize seedlings in relation to temperature (E. S. R., 32, p. 334), and of Marvin (E. S. R., 42, p. 13) and West (E. S. R., 44, p. 120) regarding the harmonic characteristics of the annual and daily march of temperature, curves are worked out from which to determine the productivity index for alfalfa on different soils, with different mean annual temperatures and different annual ranges of temperature.

Graphs and tables are also presented and discussed showing the relation of size of farm to appraised value and to resale price of land and buildings; the trends of value of buildings and of land exclusive of buildings on 10-, 20-, 40-, and 80-acre farms; the relation of appraised value of buildings to appraised value of land and buildings on 20-acre farms in the eleventh Federal farm loan district, 1918–1926; the relationship between value of buildings and price of land and buildings for 20-, 30-, 40-, and 50-acre farms; the interrelation between total and per acre building values and price per acre of dairy farm lands for farms of different sizes; and the correlations between size, building value, productivity index, percentage of land irrigated, and percentage of farm in pasture to price of dairy farm land.

Tables are also included showing the median deflated per acre prices of farm real estate for different class intervals of building value, size, percentage of farm irrigated, productivity, and percentage of farm in pasture, and the average combinations of estimated price per acre, size, productivity index, percentage of farm irrigated, percentage in pasture, and building value per acre for dairy farms in the eleventh Federal farm loan district.

The author discusses some of the difficulties presenting themselves in the use of most of the current methods of time series analysis. In briefly describing the method of R. Frisch of time series analysis used by the author in this study, he says: "The underlying assumption in this method is that an economic time series is a composite curve of many components, or trends of several orders, each cyclical in nature and fluctuating about a trend of higher order. In the process of isolating these several trends, this method first eliminates trends of the lower orders (usually the seasonal variation) leaving to be isolated the trends of higher orders. Dr. Frisch has developed two methods for the solution of the complex problem of isolating the different cyclical trends of a series. One of these he calls 'the method of normal points,' the other 'the method of moving differences.' Each is based upon the construction of a curve of second differences. The first of these methods, that is, the normal point method, is based upon the fact that the cyclical fluctuation of the curve obtained by plotting the original data passes its 'normal' at the same point where the second difference curve becomes zero. The second method, that is, the method of moving differences, depends upon the fact that within certain limiting conditions the cyclical fluctuation of the composite curve formed by plotting the original data is proportional to the ordinates of the second difference curve, the constant required to reduce the ordinates of the second difference curve to those of the curve showing cyclical fluctuations being a function of the distance between zero points, that is, between the normal points determined by the first method." Only the first method was used in this investigation.

Some Colorado tax problems, W. Coombs, L. A. Moorhouse, and B. D. Seeley (*Colorado Sta. Bul. 346 (1928), pp. 87, figs. 10*).—This bulletin describes the methods of making tax assessments in Colorado and analyzes the relations of income from and taxes on different kinds of property and the receipts and

expenditures of the State and local governments. Recommendations for changes and additional research are included.

Returns, 282 to 568 for the several years, from questionnaires sent to owners of rented farms showed that taxes in 1919, 1923, 1925, and 1926 amounted to 22.7, 37.8, 33.2, and 32.6 per cent, respectively, of the net rents before deducting taxes. Taxes in 1926 in 7 cities varied from 22.6 to 42.4 per cent of the net rent, averaging 27.4 per cent, on 94 business properties, and from 29.1 to 52 per cent, averaging 34.3 per cent, on 60 residence properties. Taxes on Colorado public utilities took 30.4 and 25.2 per cent, respectively, of the income in 1922 and 1923. The percentages of taxes of net earnings of the national banks of the State were 19, 28, 19, 24, and 21, respectively, in the years 1919, 1923, 1924, 1925, and 1926. All corporations reporting paid 22 per cent of their net income in State and local taxes, and 32 per cent in all taxes in 1924.

Total revenues of the State government increased from $3,641,168 in 1914 to $15,295,976 in 1926. The percentages derived from different sources in the two years were general property tax 43.9 and 37, inheritance tax 8.9 and 5.7, earnings of general departments 15.3 and 12.9, subventions, grants, and gifts 3.1 and 10.1, gasoline tax 0 and 13.7, other taxes 14.5 and 13.4, and other sources 14.3 and 7.2, respectively.

Government expenses and outlays for the State increased from $4,189,042 in 1914 to $15,830,123 in 1926. The percentages paid for different purposes in the two years were education 28.7 and 23.1; charities, hospitals, and corrections 13.6 and 12.8; highway maintenance 7.7 and 10.6; interest 2.2 and 3.6; outlays 0.8 and 31.9 (including 24.7 for highway construction); and other expenses 41 and 18, respectively.

The average yearly collections, 1921–1925, for county and local purposes were $53,683,375, of which approximately 82.7 per cent was practically all raised from general property taxes. The average per capita disbursements were, total $53.71, county expenses $6.95, road expenses $6.45, and school expenses $20.22.

Developments and problems in farmers' mutual fire insurance, V. N. Valgren (*U. S. Dept. Agr. Circ. 54 (1928), pp. 31, figs. 2*).—This circular discusses the growth and development of farmers' mutual fire insurance from 1916 to 1926, under the headings of combined protection, term of policy, insurance and value, fire insurance on livestock, maximum risks and reinsurance, classification and inspection, methods and costs of getting business, premiums and assessments, surplus or reserve, and standardization of forms and practices. It is based upon State insurance reports and other definite records of 1,950 companies.

During the period the average membership per company increased from 1,532 to 1,762. In 1926 the average insurance per member was $3,144. In the different geographic divisions of the United States the percentage of the value of insurable farm property insured in farmers' mutual companies varied from 4.3 to 77.4, averaging 52.1, and the annual cost per $100 of insurance, 1922–1926, from 23 to 55 cts., averaging 26 cts. Of the total expenditures in 1926, 73.8 per cent were losses and 26.2 per cent operating costs.

The agricultural outlook for 1929 (*U. S. Dept. Agr., Misc. Pub. 44 (1929), pp. 48*).—The seventh annual agricultural outlook report, prepared by the Bureau of Agricultural Economics assisted by representatives from other bureaus of the Department and from the agricultural colleges, experiment stations, or extension services of 45 States. It summarizes facts relating

to the prospective world-wide and nation-wide supply and demand conditions that will probably be encountered when the 1929 crops are ready for market.

Economics of the farm manufacture of maple syrup and sugar, J. A. Hitchcock (*Vermont Sta. Bul. 285 (1928), pp. 96, figs. 19*).—This bulletin discusses the factors affecting the unit cost of production of maple sirup. It is based upon data, collected in cooperation with the U. S. Tariff Commission, relating to cost of production of maple sirup and sugar, the proceeds from their sale, and the profits and losses from the maple enterprise on 457 Vermont farms in the spring of 1925.

The number of buckets hung per orchard varied from 200 to 5,600, the average being 1,019. Half the orchards hung 900 buckets or less, and 36 per cent hung from 500 to 800. The averages for the several elements in the cost of production per gallon of sirup were man labor 45.2 cts., horse work 17.2, fuel 27.5, interest on equipment 15.4, repairs and depreciation 21.3, interest on orchard 31.2, taxes 11.5, and miscellaneous 0.05 ct., total $1.69, and credit from by-products 0.04 ct.

Tables are included showing (1) for the orchards grouped according to the number of buckets hung, the amounts, costs, and other data regarding man labor, horse work, fuel, and equipment, and orchard investments and costs; (2) the costs, amounts of equipment, man labor, horse work, investment, etc., and other data for the orchards grouped according to the number of trees per acre, rate of tapping, date of tapping, elevation of orchard, and distance from market; (3) the items of bulk cost and the uses and costs of labor, horse work, and fuel for the orchards grouped on the basis of estimated percentage of sugar in the sap; and (4) the items of bulk cost and the uses and costs of labor, horse work, fuel, and equipment, and the items of orchard costs for the orchards grouped according to yield of sirup per bucket of sap.

Multiple curvilinear correlation analysis of the factors showed that in their relation to the cost of sirup per gallon the size of the orchard, sugar content of sap, and yield of sirup per bucket were of consequence, the coefficients of determination for these factors being 10.2, 2.7, and 47.5 per cent, respectively. No significant correlation was found between cost per gallon and number of trees per acre, rate of tapping, or distance from market. The relations between size of orchard, sugar content of sap, and yield of sirup per bucket to the cost elements are shown in the following table:

Relation between physical factors and component costs

Cost per gallon	Coefficients of determination			
	Size of orchard	Sugar content of sap	Yield of sirup per bucket	Coefficient of multiple correlation
	Per ct.	*Per ct.*	*Per ct.*	
Man labor	2.7	8.0	14.3	0.590±0.024
Horse work	4.0	9.1	11.9	0.500±0.024
Fuel	8.2	0.3	13.1	0.466±0.026
Interest on investment in equipment	3.4	−0.6	29.3	0.567±0.021
Repairs and depreciation	10.2	0.2	18.7	0.539±0.022
Interest on investment in orchard	0.4	−0.8	18.5	0.450±0.026
Taxes	0.8	−0.3	13.1	0.368±0.027

The net regressions of different cost elements on the same physical factors are shown in the following table:

Net regressions of different cost elements on physical factors

Cost element	Size of orchard	Sugar content of sap	Yield of sirup per bucket
	Increase per 1,000 buckets	Increase per 1 per cent sugar	Increase per 0.1 gallon
	Cts.	*Cts.*	*Cts.*
Man labor	−6.6	−7.3	−9.1
Horse work	−3.2	−3.3	−3.4
Fuel	−5.2	−0.6	−6.8
Unit equipment costs:			
Repairs and depreciation	−8.0	−0.2	−7.6
Interest	−3.4	0.5	−5.9
Unit orchard costs:			
Interest	−3.3	0.8	−10.0
Taxes	−1.8	0.8	−3.9

Among other tables included are those showing the relative importance of factors affecting valuation of orchard per tree; net regression, valuation of orchard per tree on miscellaneous factors; gross correlation of component costs with total bulk cost and intercorrelations; and the relation of component costs to bulk cost per gallon.

A brief review of the literature on maple costs, an account of the geographical distribution of the crop and of Vermont's place as a producer of maple goods, and a short description of the technical and commercial changes that have taken place in the industry are also included.

Economics of the farm manufacture of maple syrup and sugar, J. A. Hitchcock (*Vermont Sta. Bul. 286 (1928), pp. 24*).—This bulletin is a continuation of that noted above and analyzes and discusses the factors affecting the price received for maple sirup. Tables are given showing (1) the average prices, 1925, of sirup of different grades sold wholesale and to retail stores and of that sold retail; (2) the cost of making sugar; (3) the relation of size of orchard, yield per bucket, elevation of orchard, rate of boiling, and use of bucket covers each to the quality of sirup, and of the quality of sirup to unit cost; and (4) the effects of size of orchard, yield per bucket, method of sale, and quality of sirup each on the profits from the maple enterprise, return on labor and capital, and distribution of gains and losses.

Correlation of the percentage of sirup sold at retail, the percentage of No. 1 sirup, number of buckets hung, and gallons of sirup per bucket with return on operator's labor and with return on capital gave the following coefficients of determination and of regression, respectively: For return on operator's labor—size of orchard, 5.1 per cent and 14 cts. per 1,000 buckets; yield per bucket, 35.3 per cent and 20 cts. per 0.1 gal.; percentage sold at retail, 7.7 per cent and 2 cts. per 10 per cent; and percentage No. 1 sirup, 3.2 per cent and 1 ct. per 10 per cent; and for return on capital—size of orchard, 3.4 per cent and 2.1 per cent per 1,000 buckets; yield per bucket, 37 per cent and 3.6 per cent for 0.1 gal.; percentage sold at retail, 6.6 per cent and 0.3 per cent per 10 per cent; and percentage No. 1 sirup, 3.8 per cent and 0.2 per cent per 10 per cent.

Tables are given comparing itemized costs of producing maple goods, prices, and profits from the enterprise in 1878 and 1925. The questions of whether to tap or not and as to the advisability of lumbering off the sugar orchard are discussed briefly.

Cost and profit in the sugar orchard, J. A. Hitchcock (*Vermont Sta. Bul. 292 (1929), pp. 19, figs. 3*).—This bulletin summarizes the more salient results presented in the two bulletins noted above, without setting forth in detail the factual basis for the opinions or conclusions expressed.

What California's cost of production studies reveal concerning poultry management, M. W. Buster (*Poultry Sci., 7 (1927–28), No. 2, pp. 49–59*).—In this study, records of the costs and factors affecting egg production of 38 flocks of poultry in Sonoma County, Calif., for 1925 are given. These records give information of averages in egg production, mortality, cost, and income under various systems of management. It also furnishes a picture of the status of the industry and gives a measure of the economic position of the people engaged in this work.

Marketing locally grown raspberries in Minnesota, H. B. Price, O. A. Negaard, and W. G. Brierley (*Minnesota Sta. Bul. 245 (1928), pp. 21, figs. 6*).—The trends in production, the present marketing methods, and the fluctuations in prices received for raspberries are described, and suggestions are made for improving the marketing organization.

Crops and Markets, [February, 1929] (*U. S. Dept. Agr., Crops and Markets, 6 (1929), No. 2, pp. 33–80, figs. 3*).—This number includes the usual tables, graphs, reports, summaries, and notes; articles on the agricultural outlook, 1929, and on the disposition of the 1928 potato crop and merchantable stocks on hand January 1, 1929; and tables showing by States and geographic groups the number, value per head, and total value of different kinds of livestock on January 1, 1927, 1928, and 1929, the revised value per head of all cattle, milch cows and heifers, and hogs, 1920–1925, the average monthly prices of animals, poultry, and their products, 1910–1928; and the number of heifers one to two years old kept for milch cows, 1920–1929.

Cold-storage holdings (*U. S. Dept. Agr., Statis. Bul. 26 (1928), pp. 32, fig. 1*).—Tables are given showing the refrigerated space, October 1, 1927, by States and in leading cities, and the cold storage holdings on the first of each month, 1915–1927, and averages for 1916–1920, 1921–1925, and 1923–1927, of apples, butter, cheese, eggs, poultry, meats, lard, and fish.

Factors affecting expenditures of farm family incomes in Minnesota, C. C. Zimmerman and J. D. Black (*Minnesota Sta. Bul. 246 (1928), pp. 31, figs. 4*).—This bulletin (1) presents material collected in the fall of 1926 from 334 families in 6 communities regarding cash receipts and expenditures, (2) compares these data with those collected in 1925 (E. S. R., 58, p. 287), and (3) using the data obtained in the two studies, makes an analysis of some of the factors affecting the amount of expenditures and the quality of living.

In 1926 the average cash receipts in the 6 communities varied from $1,648 to $3,360, averaging $2,719, and the cash expenditures varied from $1,609 to $3,304, averaging $2,772. The average receipts per family exceeded the expenditures by $29, $34, and $56, respectively, in 3 communities, and the expenditures exceeded the receipts by $22, $182, and $220, respectively, in the other 3 communities. From 25.8 to 55.9 per cent, averaging 35.9 per cent, of the families in the 6 communities spent 10 per cent more than their receipts.

Tables are given showing for each community in 1926 the average expenditures per family for living, farming, investments, automobiles, food, clothing, household, health, advancement and personal, and the percentage distribution of such expenditures and the percentage distribution of the average expenditures for all families in 1925.

The 1926 data and those regarding cash receipts and expenditures obtained from the 157 families in 1925 are analyzed, and tables are included showing by groups, based on cash receipts, the average distribution of expenditures, the

relative changes in expenditures, and the average expenditures per adult-equivalent for farm, investment, automobile, and living expenses—total and by the following items: Food, clothing, household, health, advancement, and personal. Eliminating expenses necessary for the production of incomes, tables are given showing for cash receipts groups the division of farm expenditures into necessary costs and reinvestments; net spendable incomes and their proportion of cash receipts; distribution, amounts, and percentages of net spendable incomes by different groups of expenditures; and comparison of rates of increase of net spendable incomes and expenditures in different groups of expenditures.

A table is also included showing by cash receipts groups the amounts, percentages, and relative increases with increased receipts of expenditures of farm and urban people for necessities and luxuries.

Some of the findings are as follows: All expenditures increase with increase of cash reciepts. In the lower groups farm and living expenditures claim the most money, investment and automobile expenses being of insignificant importance, while in the groups above $5,000 living and investment expenditures are of equal importance. The cost of producing incomes is about the same proportion of the farm expense in all income groups. Net spendable incomes are about two-thirds of the cash receipts in all income groups except the lowest and the highest. Half of the net spendable income goes for living, and the balance is about equally divided among automobiles, interest, improving the farms, and reduction of mortgages; with increases of cash receipts, the percentages of expenditures decrease for food, are constant for clothing and personal uses, increase somewhat for health and advancement, and in the case of household decline at first and then increase, the movement being erratic. Spendable incomes of urban wage and salary earning families increase faster than expenditures for physiological necessities and slower than those for luxuries, but for farm families the spendable income increases much faster than either type of expenditnre. In the farm family expenditures the primary competition is between land investment and living, while in urban families it is between physiological and nonphysiological expenditures.

Sizes of purchasing centers of New York farm families, H. Canon (*New York Cornell Sta. Bul. 472 (1928), pp. 15, figs. 3*).—This bulletin is based on data from 325 returns from 33 counties to a questionnaire sent 9,932 patrons on certain rural postal routes in July, 1927.

Tables are given showing the number of families buying different household commodities in 1, 2, or 3 centers, the percentages of families buying 5 groups of commodities in centers of different sizes, the average distances to centers where commodities were usually bought, the number of families buying different commodities from mail order houses, the percentage of families buying each of the 5 groups of commodities from mail order houses, and the number of families buying different commodities from agents, delivery trucks, or at auction.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

A forest fire prevention handbook for the schools of Washington (*U. S. Dept. Agr., Misc. Pub. 40 (1928), pp. II+32, figs. 29*).—This publication, prepared by the Forest Service in cooperation with the State supervisor of forestry, the State superintendent of public instruction, and private timber protective organizations of Washington, includes lessons on the forests of Washington, using the forests, the forest organizations of Washington, and the causes, effects, prevention, detection, and fighting of forest fires.

Planning and conducting extension campaigns, H. W. HOCHBAUM (*U. S. Dept. Agr. Circ. 58 (1928), pp. 31, figs. 12*).—The steps to be considered in planning and conducting an extension campaign are described.

The rural church and cooperative extension work, H. W. HOCHBAUM (*U. S. Dept. Agr. Circ. 57 (1929) pp. 25, figs. 12*).—A brief description of what extension work is and how it may aid the rural church in bringing about community improvement.

FOODS—HUMAN NUTRITION

Food, nutrition, and health, E. V. MCCOLLUM and N. SIMMONDS (*Baltimore: Authors, 1928, 2 ed., rev., pp. VII+148*).—A revision of the handbook previously noted (*E. S. R., 55, p. 487*).

Visualizing food values, M. S. ROSE, M. C. HESSLER, H. K. STIEBELING, and C. M. TAYLOR (*Jour. Home Econ., 20 (1928), No. 11, pp. 781–787, figs. 2*).—This is chiefly an explanation of the previously noted method of expressing the nutritive values of foods graphically as shares of the day's requirements (E. S. R., 59, p. 188).

Food habits of Utah farm families (*Utah Sta. Bul. 209 (1929), p. 60*).—This progress report indicates that the quantities and varieties of food for home use grown on the farms of Utah compared favorably with those reported from other States in that proximity or remoteness of markets did not appear to affect appreciably either the variety or the quantity of the home-furnished foods. The dry-land wheat communities produced a larger quantity of dairy products and of beef and mutton per household than the other communities, but this is attributed to proximity to grazing lands rather than remoteness from food markets.

Studies on the metabolism of Eskimos, P. HEINBECKER (*Jour. Biol. Chem., 80 (1928), No. 2, pp. 461–475, figs. 3*).—The observations reported were made in July and August, 1927, during the Putnam Baffin Island Expedition upon Baffin Island Eskimos at Cape Dorset situated on Hudson Strait. The main objects of the experiment were to determine whether the noncarbohydrate diet of Eskimos leads to detectable ketosis, the extent to which ketosis develops on fasting and the rate at which it disappears on glucose ingestion, the carbohydrate tolerance as indicated by blood sugar curves, and the respiratory metabolism during and after a ketosis-producing fast.

The carbohydrate tolerance was determined on four subjects, three females and one male, by means of blood sugar tests during 3½ and 4 hours after the administration of large doses of glucose (about 2 gm. per kilogram) 12 hours after the previous meal and also after 82 hours of fasting. In the first instance there was only a slight rise in blood sugar, followed by the usual fall below the fasting values. After fasting, however, the high natural tolerance was temporarily greatly decreased as indicated by a marked rise in blood sugar, which remained higher than the fasting level even after 25 hours.

The values for nonprotein nitrogen of the blood were similar to those reported for other races and indicated no retention of nitrogen products from the habitually high protein diets. Three of the subjects, two females and one male, were fasted for 3 days, during which time specimens of the urine were tested qualitatively and quantitatively for ketones. Only a very mild ketosis was observed, thus indicating a remarkable power to oxidize fats completely. Determinations of the respiratory metabolism were made daily during the fast. In the first determinations made in the post-absorptive state, 10 or 12 hours after the last food, the respiratory quotients were normal, but the values for total metabolism were much higher than the standards for subjects in temperate

zones. As fasting progressed the respiratory quotients fell, but in two of the subjects the total metabolism showed no tendency to fall. The lower levels reached in the respiratory quotient are interpreted as indicating a conversion of fat into carbohydrate.

The adequacy of some New Zealand dietaries, L. B. STORMS and E. N. TODHUNTER (*Jour. Home Econ., 20 (1928), No. 11, pp. 817–824*).—This report is based upon a survey of dietary habits in different sections of New Zealand by means of a collection of weekly menus from 710 families with an average of 5.7 persons per family, and a quantitative study of the food consumption of 12 families for a period of 1 week.

The data obtained in the qualitative study are reported in terms of the frequency of serving of the principal articles of food, the average figures for all families and seasons being meat 11.2, vegetables other than potatoes 6.2, green vegetables 2, frnit 6.3, and brown (whole wheat) bread, 1.5 times per week.

The 12 families selected for the quantitative study represented both laboring and professional classes, but the average financial standing was higher than that of the families included in the survey. The data are presented by occupational groups and include energy and protein per man per day, percentage distribution of calories among the different groups of foods, and calcium, phosphorus, and iron per person per day in grams and per 3,000 calories.

All of the diets except one met the occupational energy standards of Atwater, and in all the protein furnished more than 10 per cent of the total calories. The average values for calcium, phosphorus, and iron were low whether calculated in actual weight or in percentages of total calories. The average percentage distribution of calories among the different groups of foods was as follows: Eggs 1.6, milk and cheese 9.0, meat and fish 15.7, fruit and vegetables other than potatoes 8.2, potatoes 4.2, cereals 26.3, sugar and jam 13.2, fats 18, and miscellaneous 4.4 per cent.

It is suggested that the low calcium and phosphorus content of the diets, together with their high sugar content, may be responsible in part for the high incidence of dental caries in New Zealand.

The food of Japan, E. C. GREY (*Geneva: League of Nations, Health Organ., 1928, pp. 161, figs. 8*).—This is the complete report of an investigation conducted by the author at the Imperial Institute of Nutrition, Tokyo, on behalf of the Health Section of the League of Nations for the purpose of supplying as complete information as possible in regard to the food of Japan as a basis for the study of the relation of food to the health of the Japanese people. Both the statistical and analytical data reported were obtained by the author, no data from other workers being included. The subject matter is arranged in five chapters dealing, respectively, with the quantity, quality, and distribution of food in Japan and the chemical composition of Japanese foods as consumed and as purchased. The tables of food composition include proximate analyses, percentages of total nitrogen, P_2O_5, NaCl, CaO, Fe_2O_3, and insoluble and soluble ash, together with calculations of the alkali value and the alkalinity in terms of sodium and potassium hydroxide and lime and magnesia. Lists of references (with translated titles) to Japanese literature and an index of food materials in Latin, Japanese, and English are given in appendixes.

New kinds of leguminous flours [trans. title], D. KALCHEVA (*God. Sofiisk. Univ., Fiziko-Mat. Fakult. (Ann. Univ. Sofia, Facult. Physico-Math.), 24 (1927–28), No. 2–3, pp. 23–56; Eng. abs., pp. 54–56*).—Methods of preparing palatable flour from soybeans and chickpeas are described, and data are given on the chemical composition of the flours and the original materials. To prepare the soybean flour the soybeans are soaked for 30 hours in water containing 5 per cent of salt and 5 per cent of soda, the water being changed frequently.

The beans are then cooked in a pressure cooker for 3 hours and dried, ground to a flour, and heated to 110° C. A similar process, with slight differences in time, is recommended for the chickpeas, a 24-hour period for soaking and 1½ hours for cooking in the pressure cooker. The flour is finally heated at from 120 to 130° for 1 hour.

Proximate composition of fresh fruits, C. CHATFIELD and L. I. MCLAUGHLIN (*U. S. Dept. Agr. Circ. 50 (1928), pp. 20*).—This circular is intended to replace that section of Office of Experiment Stations Bulletin 28 (E. S. R., 11, p. 379) dealing with the composition of fresh fruits and fruit juices. Most of the figures in the earlier summary have been included and in addition published and hitherto unpublished data from many sources after careful and critical study.

The compilation includes data on 67 kinds and varieties of fruits and 31 fruit juices. As a further aid to accuracy, the botanical as well as the common name is given for each fruit. For varieties that differ markedly in composition or for types grown in different localities separate averages are given. In the tables the various constituents are given in percentages of the edible portion of the fruit. Fuel value appears as calories per pound and per 100 gm. In making the tables, particular care was taken to determine what part of the fruit was considered refuse in making the analyses and to designate the refuse percentage as skin, seeds, or other inedible portion.

Confections (*Oregon Sta. Bien. Rpt. 1927–28, p. 96*).—Methods of utilizing apples and prunes in confections are described briefly. Apples are boiled slowly until transparent in a 32° Balling sugar solution to which a slight amount of citric acid has been added, and are then removed from the solution, rolled in granulated sugar, and dried in a cabinet maintained at a temperature not exceeding 90 to 100° F.

The prune confection is prepared by mixing finely ground prunes with one-third of their weight of sugar and boiling the mixture for 10 minutes with about 2 per cent of agar agar dissolved in a small quantity of water. The mixture is whipped until the agar begins to harden and then poured into a mold, cut when cold, and dipped in chocolate.

Experiments on the nutritive properties of gelatin, R. W. JACKSON, B. E. SOMMER, and W. C. ROSE (*Jour. Biol. Chem., 80 (1928), No. 1, pp. 167–186, figs. 5*).—Systematic attempts to determine the nature of the inadequacies of gelatin as a source of nitrogen for maintenance and growth are reported.

The addition of appropriate quantities of cystine, tyrosine, and tryptophane to diets containing 35 per cent of gelatin as the sole source of protein was partially but not entirely successful. About half of the entire number of rats, after periods of adjustment during which there was marked loss in weight, were able to maintain body weight and in some cases to grow at varying rates. Reducing the level of gelatin from 35 to 15 per cent and adding the 11 amino acids judged to be present in too small amounts in that level of protein failed to render the food more satisfactory for growth. Diets containing hydrolyzed gelatin supplemented with amino acids were no more successful than similar diets containing unhydrolyzed gelatin, thus showing that the peculiar inadequacies of gelatin are not due to the presence of amino acid linkages which can not be severed by the digestive fluids of the intestinal tract.

Data on the food consumption and body weight changes of the experimental animals are interpreted as indicating that the failure of appetite follows the failure in growth. The frequent incidence of severe renal injury on the high gelatin diets is considered to be the cause of inhibition of growth and death rather than the amino acid deficiency.

Studies on the composition of human milk, M. Bell (*Jour. Biol. Chem., 80 (1928), No. 1, pp. 239–247, fig. 1*).—Reports of analyses of the milk of 88 normal women for protein, sugar, and fat and of 60 for ash are reported and compared with data from the literature, particularly the observations of Hammett (E. S. R., 37, p. 273).

Two samples were obtained from each subject, one on the fifth and one on the ninth day post partum, together with one or two additional samples from 50 of the subjects at later periods up to 8 weeks. The ordinary hospital diet and diets high in carbohydrate and fat, respectively, were used in order to determine the effect of differences in the composition of the diet on that of the milk.

As judged by the averages of all analyses, the protein content of the milk decreased rapidly at first and then more slowly. The fat and sugar decreased rapidly and then slowly until a constant level was reached and maintained. The ash decreased from the fifth to the ninth day and was not studied further. These tendencies corresponded with those observed by Hammett, as did also the observation that the range of variation of protein and lactose narrows in the later period, while the fat remains variable. No tendency was noted toward a uniform production plane for individual subjects. Supplementary feedings of carbohydrate and fat made only slight differences in the composition of the early milk. The average volumes secreted, however, were greater after supplementary feedings of carbohydrate and less after fat than in the controls.

The availability of ergothioneine in supplementing rations deficient in histidine, B. A. Eagles and G. J. Cox (*Jour. Biol. Chem., 80 (1928), No. 1, pp. 249–254, fig. 1*).—Ergothioneine, recently discovered as a normal component of animal blood, has been tested as a possible substitute for histidine in rat feeding experiments with negative results.

Manganese as a factor in hemoglobin building, R. W. Titus and H. W. Cave (*Science, 68 (1928), No. 1765, p. 410*).—A preliminary note, with substantiating data, indicating that manganese in small amounts is effective as a supplement to iron in hemoglobin formation in rabbits rendered anemic on a whole milk diet.

Recent research on the vitamins, K. H. Coward (*Pharm. Jour. and Pharm. [London], 4. ser., 67 (1928), No. 3398, pp. 572–575*).—This is a concise review of recent literature on vitamin research, together with a brief description of the work of the vitamin department of the pharmacological laboratories of the Pharmaceutical Society of Great Britain.

Nomenclature of the accessory food factors, R. L. Jones (*Science, 68 (1928), No. 1768, pp. 480, 481*).—A new system of vitamin nomenclature is proposed which involves discarding the general term *vitamin* and substituting for it the term *advitant*, and substituting for the alphabetical designation a prefix denoting the disease for which the vitamin is the preventive and the suffix *amin*, and replacing this suffix by one denoting chemical structure when this shall have been determined. Under this nomenclature vitamin D would receive the provisional name rachitamin, to be changed to rachitasterol when its identity as a sterol is definitely established. The names suggested for the other vitamins are for vitamin A ophthalamin, vitamin F polyneuramin, vitamin G pellagramin, vitamin C scorbutamin, and vitamin E sterilamin.

The meaning of vitamin A, H. C. Sherman (*Science, 68 (1928), No. 1773, pp. 619, 620*).—This is a criticism of the system of nomenclature proposed by Jones, as noted above, on the ground that the naming of any vitamin from a disease for which it is preventive gives an unfortunate pharmacological bias. In the author's opinion "the alphabetical designations of the vitamins, while admittedly colorless, have the very great advantages of freedom from such bias

and from connotations inconsistent with anything which may be learned by further study of these substances. Under the noncommittal designation of a mere letter, our knowledge of any vitamin may grow in any direction without the development of inconsistency between the designation of the substance and its more newly discovered properties, and without the development of a situation in which the name would appear to put the emphasis in the wrong place."

Using vitamin A as an illustration, a brief review is given of present knowledge concerning its significance in many other ways more important than in preventing ophthalmia, particularly in contributing to the condition of general health and vigor, both in the individual and in successive generations.

The effect of hydrogen ion concentration upon adsorption of the active factors of vitamin B complex by fuller's earth, W. D. SALMON, N. B. GUERRANT, and I. M. HAYS (*Jour. Biol. Chem., 80 (1928), No. 1, pp. 91–101, figs. 2*).—The adsorbates used in this investigation included one from an extract of maize and two from yeasts. The maize extract, which serves as a convenient source of vitamin F, is prepared by drying the white maize at 45 to 50° C. and extracting the finely ground material by percolation at room temperature with 80 per cent alcohol by weight until 225 liters of extract are obtained from 150 kg. of maize. The extract is then reduced by vacuum distillation to a volume of 15 liters, allowed to cool, and the precipitated protein removed by kneading as thoroughly as possibly, pouring off the extract, and kneading in three successive portions of water. The washings are added to the extract, and the total volume is made up to 21.5 liters with water, filtered, and again reduced by vacuum distillation to 15 liters. The extract is kept in an electric refrigerator for about 48 hours and then filtered by suction and diluted to 16.5 liters.

The yeast extract was prepared by heating 8 liters of water acidulated with 0.75 per cent by volume of glacial acetic acid to 95° and stirring in 2.5 kg. of dry bakers' yeast. After thorough agitation the mixture was allowed to cool to 60° and then treated with 12 liters of 93 per cent alcohol. The coagulate was filtered on a Buchner funnel and again extracted with 4 liters of warm 51 per cent alcohol, and the combined filtrates were concentrated by vacuum distillation to 6.6 liters, left in the refrigerator overnight, and filtered. The reactions of portions of the extracts were adjusted with H_2SO_4 or NaOH to 10 different pH values. In preparing the adsorbates, 3 gm. of English fuller's earth were used per kilogram of maize and 160 gm. of American fuller's earth per kilogram of yeast for one sample of yeast and $1\frac{4}{7}$ as much of the fuller's earth for the second sample.

The vitamin F (B–P) tests with the various adsorbates were conducted on pigeons and the vitamin G (P–P) tests on rats, following the methods used in previous studies (E. S. R., 60, p. 596). The results obtained show that the reaction of the solution determines to a large extent the efficiency of the adsorption of either of these factors by fuller's earth, but that there is a significant difference in the effect of the H-ion concentration upon the adsorption of the two factors. The maximum adsorption of vitamin F was in the zone between pH 3 and 5.5, with the optimal point at pH 4. With increased alkalinity the adsorption diminished rapidly, becoming negligible at pH 9 and practically 0 at pH 11. The maximum adsorption of vitamin G occurred at pH 0.08, with a gradual decrease to pH 6.3, beyond which it remained constant to about pH 12.07, the most alkaline solution tested.

As judged by the relative efficiency of the adsorbates of the two factors and the completeness of the removal from solution, fuller's earth is a much better adsorbant for vitamin F than for vitamin G. These differences, together with the similarity between the effect of pH upon the adsorption of the F fraction and quinine and of the G fraction and glucose, as noted on page 12, "seem to

suggest phenomena associated in the one case with the polar and in the other with the apolar type of adsorption."

Dietary requirements for fertility and lactation, XIX, XX, B. SURE (*Jour. Biol. Chem., 80 (1928), No. 1, pp. 289–307, figs. 6*).—Continuing the series previously noted (E. S. R., 60, p. 293), two papers are presented.

XIX. *Does copper supplement vitamin B for lactation?* (pp. 289–295).—The possibility that the favorable effect of yeast concentrates on lactation is due to the ash constituents, particularly copper, was suggested by the work of Hart et al. (E. S. R., 59, p. 892.) Attempts to use the ash of yeast or lettuce or small amounts of copper in the form of copper sulfate in place of yeast concentrate in the diet of the lactating mothers or nursing young were unsuccessful.

XX. *A differentiation of the vitamin B complex in rice polishings as evidenced in studies of lactation* (pp. 297–307).—This paper reports an attempt to determine which of the factors in the vitamin B complex (vitamins F and G, or B and F in the nomenclature preferred by the author) is involved in the inefficiency of the vitamin B complex for lactation as shown by the greater requirement for lactation than for growth. When lactating rats on a vitamin B-deficient diet showed depletion of vitamin reserves, the substitution of rice polishings for dextrin to the extent of 30 per cent of the ration caused phenomenal growth in the young for a short time, followed by maintenance. The addition of autoclaved yeast to the mother's diet brought about another increase in growth. With a smaller amount of rice polishings large increases in the amount of autoclaved yeast failed to promote growth. Similar results with an alcoholic solution of rice polishings and autoclaved yeast also showed the need for both vitamins F and G for lactation, and incidentally demonstrated that rice polishings are a relatively rich source of F and poor of G.

Sparing action of fat on the antineuritic vitamin, H. M. EVANS and S. LEPKOVSKY (*Science, 68 (1928), No. 1761, p. 298*).—This is a brief note to the effect that in the authors' experience the amount of the antineuritic vitamin required to establish any definite level of growth or frequency of ovulation in rats is always less on diets containing fat than on fat-free diets. Rats on inadequate amounts of this vitamin also develop fatal beriberi sooner when fat is absent than when present, and when near death from beriberi respond more readily to doses of rice polish extract in the presence of fat. These results are thought to afford a partial explanation of the beneficial effect of fats on highly purified diets (E. S. R., 59, p. 489).

[Vitamin C content of canned spinach] (*South Dakota Sta. Rpt. 1928, p. 16*).—In this progress report it is stated that spinach canned by blanching for 2 minutes and processing for 70 minutes at 15 lbs. pressure, as recommended in the previous report (E. S. R., 58, p. 794), did not prove to have as high a content of vitamin C as commercial canned spinach, 10 gm. of home canned and 5 gm. of the commercial canned both being on the border line as the daily protective dose for guinea pigs. It is suggested that the difference may be due to the fact that the spinach used in home canning was not local, and may have lost some of its vitamin C between the time of picking and canning.

The photosynthesis of the antirachitic vitamin by ultra-violet radiation of short wave-length, H. D. GRIFFITH and K. C. SPENCE (*Brit. Jour. Actinother., 3 (1928), No. 4, pp. 69–72, figs. 2*).—In this investigation the method of exposure of ergosterol to ultra-violet light of definite wave lengths was by means of exposure in the spectrum formed by a quartz prism and lens in a specially constructed monochromator producing a spectrum of great intensity and considerable surface. The apparatus and the technique of the exposure are de-

less than 265μμ, and between these two values. Young rats which had been on the McCollum rachitic diet 3143 for 3 days were given for a period of 4 weeks doses of the material which had been irradiated for 15 hours in this manner and also for a short time by the entire spectrum. At the end of 2 and 4 weeks X-rays were taken, and the results were checked by line tests at the end of the experiment.

Those receiving ergosterol irradiated by the 313 to 265μμ band showed normal ossification, below 265μμ a slight tendency to rickets at the end of 2 weeks, but protection at the end of 4, and above 313μμ definite rickets.

The demonstration that rays shorter than 265μμ are capable of synthesizing vitamin D is thought to be of interest, but to require further consideration in regard to their applicability for irradiating living animals, since rays shorter than 280μμ have so little penetrating power for living tissues.

Notes on the irradiation of ergosterol, T. A. Webster and R. B. Bourdillon (*Biochem. Jour., 22 (1928), No. 5, pp. 1223–1230, pls. 2, fig. 1*).—In continuation of the studies of Rosenheim and Webster (E. S. R., 58, p. 794) further attempts have been made to produce more concentrated preparations of vitamin D by the irradiation of ergosterol by selected portions only of the ultra-violet spectrum, alcoholic cobalt chloride being used as the filter.

Preliminary tests with the filter, which effectively cuts out wave lengths shorter than 265 μμ, showed no effect upon the equilibrium between the formation and destruction of the vitamin. The tests were extended over a wide range of temperature to determine whether temperature changes during irradiation affect the results. As tested on rats, all products except those in liquid oxygen or nitrogen had approximately equal activity, although they had been prepared in temperature ranges of +78 to −18° C. The lack of marked effect of such a wide temperature range is thought to indicate that the temperature coefficients for the production and destruction of vitamin D are not widely different.

The products remaining after the removal, by means of digitonin, of unchanged ergosterol from solutions irradiated for short periods formed a transparent glassy solid of indefinite melting point, much more soluble in alcohol than ergosterol, moderately soluble in methyl alcohol containing 10 per cent of water, very soluble in ether, chloroform, and light petroleum, but insoluble in water. The highest observed antirachitic activity was about twice that of the standard irradiated ergosterol used for comparison.

Absorption spectra of these products and of ergosterol after irradiation for different lengths of time have led to the hypothesis that "irradiation of ergosterol produces two substances in succession, of which the first has an absorption maximum at about 280 or 290 μμ, and the second a maximum at about 230 μμ, and that the former is vitamin D. This hypothesis would explain the variable absorption of the products obtained after removing ergosterol from irradiated mixtures, and would also fit the absorption changes found by us in the early stages of the irradiation of ergosterol and the changes found by the other authors quoted in the later stages. On any hypothesis the products of irradiation must show considerable antirachitic activity until some time after the practical disappearance of ergosterol, and this makes the evidence attributing absorption at 240 μμ to vitamin D open to question unless a quantitative relation between such absorption and antirachitic activity can be shown. As arguments suggesting a connection between vitamin D and absorption at 280 μμ may be quoted the very early production of marked antirachitic activity on irradiation of ergosterol, and the fact that in our experiments we have always found marked absorption at 290 and 300 μμ in products showing antirachitic activity."

Preventive irradiation of children against rickets, K. Huldschinsky (*Brit. Jour. Actinother., 3 (1928), No. 6, pp. 103–105, fig. 1*).—A plan for the prevention of infantile rickets by irradiation has been developed by the author following observations made in a public welfare center in Berlin of the effect of systematic irradiation of babies for one month at about three months of age. While this was found to prevent severe rickets, it is considered advisable to repeat the treatment twice after intervals of one or two months. A chart is given showing the months in which irradiation should be given, depending upon the month of birth. Irradiation of women during pregnancy is thought to be of little value in the prevention of rickets in the children, but of value in preventing osteomalacia in the women themselves.

The use of ultra-violet light transmitting windows, W. H. Eddy (*Amer. Jour. Pub. Health, 18 (1928), No. 12, pp. 1470–1479, figs. 3*).—To determine the efficacy of Vitaglass in the prevention of rickets in New York City and vicinity, three series of experiments were run. In the first, cages of rats on the Sherman-Pappenheimer rachitic diet were placed in different positions in rooms with the same exposure and differing only in that one had Vitaglass and the other ordinary glass. After 30 days, from January 18 to February 16, 1928, only the rats in the cages placed in direct sunshine in front of the windows in the Vitaglass room showed any protection from rickets.

In the second experiment, which was conducted in the author's laboratory in New York City, rats were exposed in south windows containing solarized and unsolarized Vitaglass and ordinary glass. Three experiments were run in March, April, and from May 20 to June 20. The rats behind both forms of Vitaglass were protected against rickets in the first two experiments, but not in the third, during which time there was considerable rainy weather. All of the window-glass controls showed active rickets.

The third series was arranged to determine whether or not the location of the windows is a matter of importance. Two rooms in the same building in which the first series of experiments was conducted were equipped with Vitaglass, one room having a western and the other an eastern exposure. Two cages of rats were placed in each room, one directly in front of the window and one on a shelf out of the direct rays. For the time of exposure, April and May, no differences could be detected between the east and west exposure. The animals directly in front of the Vitaglass windows were protected and the others were not.

In commenting upon these findings, the author states as his opinion that "schools and office buildings would invest their money more efficiently by equipping solaria, preferably with sky lighting and sex-segregated so that the needy cases could lie exposed for certain periods of the day to the full effect of the sun, with as little clothing as possible. I do see a place in homes and apartments for these glasses to permit mothers to save some hours of perambulation with the baby or chaperonage of small children."

The intestinal pH in experimental rickets, B. L. Oser (*Jour. Biol. Chem., 80 (1928), No. 2, pp. 487–497, figs. 4*).—In this study of the reliability of the fecal pH test as a measure of vitamin D potency, the Steenbock-Black rickets-producing diet 2965 was used alone and with additions of 2 per cent of ammonium chloride, 2 per cent of sodium carbonate, and 4.2 per cent of sodium lactate, respectively, and with or without cod-liver oil or ultra-violet radiation of the rats. The pH determinations were made colorimetrically twice a week on the filtrates from homogeneous suspensions of the fecal material in distilled water. The animals were finally killed by asphyxiation with illuminating gas, and the contents of four sections of the intestinal tract were used for pH determinations.

The fecal pH curves were irregular and showed in some cases a well-marked rhythmicity. No definite pH border zone between normal and rachitic reaction could be established. In general high pH values prevailed in the rachitic condition and low values followed curative or preventive measures, but exceptions to this rule were often noted. Changes in pH sometimes accompanied the change in diet, but were not necessarily related to altered calcification. The addition of the various salts produced no effects not shown by the basal diet alone either in rachitic changes or in fecal pH.

No differences between normal and rachitic rats could be noted in the contents of the upper ileum. The alkalinity tended to increase along the intestinal tract to the cecum, with somewhat higher average values for the rachitic than the nonrachitic rats. In the colon the alkalinity did not change in the rachitic rats, but decreased in the normal. The decreased alkalinity in the normal animals is thought to be related to phosphorus reabsorption, and the sustained increase in alkalinity in the rachitic rats to be associated with inadequate phosphorus absorption. "Since even the rachitic rat has been shown to absorb and utilize calcium to a certain degree, it is probable that the primary etiological disturbance in rickets is the loss of phosphorus from the lower bowel, and the consequent decrease in the level of this element in the blood plasma. Fasting, being accompanied by inadequate calcium intake, may affect recalcification because of the conservation or restoration of the inorganic phosphorus level in the 'bathing fluid' of the bones."

The question of rickets prophylaxis [trans. title], A. Adam (*Klin. Wchnschr.*, *7 (1928), No. 38, pp. 1825–1828*).—This is a discussion of the relative merits of rickets prophylaxis by the use of irradiated milk or milk to which irradiated ergosterol has been added in oil emulsion in amounts of 1 mg. to 1 liter of milk. In the author's opinion the latter method is preferable.

The destruction of vitamin E in a ration composed of natural and varied foodstuffs, J. Waddell and H. Steenbock (*Jour. Biol. Chem.*, *80 (1928), No. 2, pp. 431–442, fig. 1*).—Evidence is reported indicating that the vitamin E potency of a ration composed of natural and varied food materials, such as the stock ration described by Steenbock (E. S. R., 50, p. 765), may be completely destroyed by treatment with ferric chloride in the proportion of 1 per cent added to 99 per cent of the ration.

The iron was incorporated in the ration by dissolving ordinary ferric chloride in ether with a small amount of water, pouring the solution over the ration, and allowing the ether to evaporate. Complete sterility in the first gestation resulted on this diet. The treatment did not affect the vitamin A content of the ration or reduce its palatability appreciably.

TEXTILES AND CLOTHING

A brief outline of the British woolen industry, E. M. Poggi (*Jour. Home Econ.*, *20 (1928), No. 11, pp. 788–796, fig. 1*).—A historical discussion of the development of the woolen industry in England, Scotland, and Ireland.

A study of weighted silk fabric, M. Furry and R. Edgar (*Jour. Home Econ.*, *20 (1928), No. 12, pp. 901–905, figs. 2*).—The silk fabrics used in this study were a degummed and a weighted radium of mulberry silk and a pongee of wild silk. The radium silk was purchased in the gum and part of it degummed in the laboratory, and part degummed and weighted with tin phosphate by a commercial dye works. All four of the silks were analyzed, and all but the raw radium were compared as to deterioration due to laundering and dry cleaning and exposure to dry and moist heat at 100° C. The tests after treatment included measurements of weight, thickness, ash, shrinkage, folding en-

durance, and breaking strength according to methods previously described (E. S. R., 60, p. 198).

The unweighted silk was scarcely weakened after the 25 dry cleanings and launderings. The weighted silk lost about 30 per cent in breaking strength in laundering and about 15 per cent in dry cleaning, and the wild silk 50 per cent in laundering and 55 per cent in dry cleaning. After 46 hours' exposure to dry heat at 100° the unweighted lost 25 per cent, the weighted 22, and the wild silk 34 per cent in breaking strength. Corresponding losses for the same length of exposure to moist heat were 48, 55, and 81 per cent.

Identification of rayon, W. D. Grier (*Indus. and Engin. Chem., 21 (1929), No. 2, pp. 168–171, figs. 20*).—The microscopic characteristics of different types of rayon are described, with details of the technique and apparatus needed for microscopic work.

Rayon year book, 1928–29 edition, compiled by Textile World (*New York: Bragdon, Lord & Nagle Co., 1928, pp. [2]+13–212, pl. 1, figs. 66*).—This volume embraces articles by different authors on the status of the rayon industry, trends and advances in manufacturing processes, utilization of rayon, style, dyeing, finishing, and the reaction of rayon to various factors encountered in manufacture and use. A directory of rayon yarn producers in different parts of the world is appended.

MISCELLANEOUS

Report on the agricultural experiment stations, 1927, E. W. Allen, W. H. Beal, J. I. Schulte, et al. (*U. S. Dept. Agr., Off. Expt. Stas., Rpt. Agr. Expt. Stas. 1927, pp. 124*).—This report contains a discussion of the activities of the stations during the fiscal year ended June 30, 1927, a résumé (pp. 22–77) entitled Some Results of Recent Station Work, two special articles noted elsewhere in this issue, a list classified by subjects of the publications of the stations received during the year, and Income, Expenditures, and Other Statistics, 1927, by J. I. Schulte (pp. 115–124).

Director's Biennial Report [Oregon Station], 1926–1928, J. T. Jardine (*Oregon Sta. Bien. Rpt. 1927–28, pp. 133*).—This contains the organization list and a report of the director for the biennium ended June 30, 1928, including synopses of departmental reports and notes on the substations. The experimental work reported is for the most part abstracted elsewhere in this issue.

Annual Report [of South Dakota Station, 1928], J. W. Wilson (*South Dakota Sta. Rpt. 1928, pp. [2]+32*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1928, and department reports on the work of the station during the year. The experimental work reported is for the most part abstracted elsewhere in this issue.

Biennial Report of Director [of the Utah Station, 1927–28], W. Peterson et al. (*Utah Sta. Bul. 209 (1929), pp. 84*.)—This contains the organization list and a report on the work and publications of the station during the biennium ended June 30, 1928. The experimental work reported is for the most part abstracted elsewhere in this issue.

Forty-first Annual Report [of the Vermont Station, 1928], J. L. Hills (*Vermont Sta. Bul. 291 (1928), pp. 16*).—This contains the organization list, a report of the director, and a classified list of available bulletins.

New monograph bulletins (*Ohio Sta. Circs. 1 (1925), p. 1; 2 (1926), pp. 2; 5 (1927), pp. 2*).—Brief notes are given on Bulletins 379–383; 384–394; and 395–403, respectively.

[Miscellaneous papers from the Panhandle Station] (*[Oklahoma] Panhandle Sta., Panhandle Bul. 3 (1929), pp. 14*).—In addition to several articles abstracted elsewhere in this issue, this number contains a soil moisture report as of February 15, 1929.

NOTES

California University and Station.—The legislature has authorized the regents of the university to sell the old campus and buildings at Los Angeles with the provision that from the proceeds $125,000 is to be used for the construction of a new wing to the main building at the Citrus Experiment Station, Riverside, and $150,000 for the construction of a building for subtropical horticulture on the new campus of the university at Los Angeles. The total budget of the College of Agriculture for 1929–30, exclusive of the above items, is $2,394,871.32, an increase of about $155,000 over the present year. Among the special allotments provided is $25,000 for an insectary at the Citrus Experiment Station.

Dr. H. J. Webber, professor of subtropical horticulture and director of the Citrus Experiment Station, retired from the directorship June 30 to devote his entire time to his research project on citrus stocks. He has been succeeded in this capacity by Dr. L. D. Batchelor.

Connecticut College and Storrs Station.—*Science* notes that Dr. Dewey G. Steele, instructor in biology at Yale University, has been appointed assistant professor of genetics in the division of resident teaching and assistant geneticist in the station.

Delaware University and Station.—Dr. Claude L. Benner, professor of economics and chief of the department of agricultural economics in the station, who has been on a year's leave of absence, has tendered his resignation, effective June 30, in order to engage in commercial work. H. R. Baker, assistant professor of bacteriology and research assistant in bacteriological investigations in the department of animal industry, has resigned effective August 1 to become poultry pathologist for the State board of agriculture.

Georgia Station.—The station has recently occupied its new administration building. This is a commodious two-story and basement brick structure, erected at a cost of about $60,000, and greatly enlarges and modernizes the equipment of the station. Accommodations are provided for the entire staff with the exception of the departments of horticulture and entomology. The building has been named the Flynt Building in honor of Judge J. J. Flynt of Griffin, a prominent member of the board of directors for many years.

Kansas College and Station.—*Kansas Industrialist* announces that Walter H. Burr, professor of sociology, has resigned to become professor of rural sociology in the University of Missouri. R. H. Lush, assistant professor of dairy husbandry and dairy husbandry investigator, has resigned to accept a position in the Louisiana Stations where he will carry on research in dairy production beginning July 1.

Louisiana University and Stations.—A new dairy building consisting of a two-story main structure and a one-story addition for a creamery is nearing completion. This building will provide adequate space for some time for teaching and research in dairy production and manufacture. The creamery will be equipped with modern machinery, student laboratories will be fitted up, and space has been provided for research in dairy manufacture and production.

The two-story building and one of the one-story buildings which will ultimately constitute the group for animal pathology will probably be ready for occupancy by the beginning of the next school year. Teaching and research in veterinary medicine and research in parasitology will be carried on in this

latter building. Plans have been drawn for an experimental feeding shed for beef cattle and sheep, and a seed house will also soon be built for the department of crops and soils for use in its research work.

The growing lot of the poultry department has been found to be highly infected with coccidiosis. Arrangements have been made by which 6 acres will be fenced, 2 acres being used every three years as a growing lot for young poultry. Portable houses are being provided for these growing lots, and in this way it is hoped to avoid infection.

The department of animal husbandry has bought considerable improved livestock, including Shorthorn and Hereford bulls, Hampshire and Southdown sheep, and Poland-China hogs. Some poultry breeding stock has also been purchased, and a Holstein bull is to be acquired. Another purchase is that of a jack of outstanding merit to be used for general service and also in a new breeding experiment.

Tests were begun this spring to continue over a period of years at eight different points in the State with cotton, corn, and soybeans, and in some places with oats. These outfield tests have been located with reference to the different soil types and will comprise variety tests of cotton, corn, soybeans, and oats; fertilizer tests with cotton and corn; the following of soybeans with cotton and corn; and probably later on some simple rotations. These tests are for the purpose of finding the variety of each crop that is best adapted to each soil type and the fertilizer requirement of different soils.

Arrangements have been made by which the stations are cooperating with the U. S. D. A. Bureau of Chemistry and Soils in soil investigations with reference to sugarcane. A reconnoissance survey of the soils in the sugar-growing territory of the State has been made, and outfield tests are being located on the different soil types represented. For the current year tests are being made with commercial fertilizers, but it is expected that later on rotations including soybeans and *Melilotus indica* will be undertaken.

The new varieties of cane that have been introduced contain much more fiber than the old varieties, and on this account they are hard to grind. Many of the smaller mills have had difficulty in getting a good extraction, and a study has been begun by the sugar engineer of how to increase the efficiency of these mills.

A new substation has been established at St. Joseph. Tensas Parish, in the delta section of the State, where 160 acres of land have been donated to the university by the parish. Buildings are to be erected and plans matured for a full program next year.

At the Hammond Substation new work has been begun with variety and fertilizer tests with beans, and it is planned to include work with peppers and cabbage. All of these crops are grown quite extensively in the region.

The program of the North Louisiana Station at Calhoun has been extensively revised following a conference of the extension division, the station superintendent, and members of the station staff. It is planned to add dairy cattle, hogs, and poultry to the station equipment with a view to stimulating interest in livestock in the region and ultimately, if funds are available, to take up some experimental work of a simple nature.

Dr. R. L. Mayhew, who was made a part-time member of the station staff, is to devote his full time to work in parasitology. On July 1, A. H. Meyer, Dr. Julian C. Miller, and R. J. Saville were added to the station staff for researches, respectively, on soils, vegetable crops, and farm management. C. B. Haddon has been appointed superintendent of the new cotton substation at St. Joseph.

Mississippi Station.—J. O. Smith and R. B. Carr have been added to the staff of the Delta Substation, the former as agricultural engineer and the latter as assistant plant breeder.

North Dakota College and Station.—President John Lee Coulter has been appointed chief economist of the U. S. Tariff Commission. Dr. H. R. Thornton, assistant professor of bacteriology, dairy bacteriologist, and assistant soil biologist, has resigned effective September 1 to become professor of dairying in the University of Alberta. R. C. Hastings of the Minnesota State Department of Agriculture has been appointed potato grades inspector, and Walter A. Davidson seed analyst and inspector in the pure seed laboratory.

Pennsylvania College.—Arrangements have been made for a veterinary course in cooperation with the Veterinary School of the University of Pennsylvania. A six-year course is to be provided under this plan, the first three years to be spent at the college with specialization in animal husbandry, dairy husbandry, or poultry husbandry, followed by three years in the Veterinary School. Degrees of B. S. and V. M. D. will be conferred and one year's work eliminated.

Rhode Island Station.—Dr. Louis H. Schwarte, assistant animal breeder and pathologist, has been appointed associate animal breeder and pathologist. Fred K. Crandall, assistant in field experiments, has been made assistant agronomist.

Tennessee Station.—The station has just completed a greenhouse, 28 by 33 ft., with a head house consisting of a storage room, laboratory room, and concrete basement. This equipment is for the use of the department of plant pathology.

West Virginia Station.—Felix John Schneiderhan, associate plant pathologist in the Virginia Station, has been appointed associate plant pathologist.

Office of Experiment Stations.—At the recent commencement of the University of Missouri on June 5, the honorary degree of doctor of laws was conferred on Dr. E. W. Allen. In conferring the degree President S. D. Brooks of the university spoke as follows: "As chief of the National Office of Experiment Stations, you have insisted on the highest standards and encouraged fundamental research in the sciences. As editor and author, you have done notable work in advancing the cause of scientific agriculture. As supervisor of Federal funds appropriated to the colleges and universities of this country for the benefit of agriculture, you have been ever alert, discriminating, and effective."

Southwest Arboretum of the Boyce Thompson Institute for Plant Research.—This arboretum, located at Superior, Ariz., 60 miles east of Phoenix, was dedicated April 6. The program included addresses by Governor John C. Phillips of Arizona, President Leroy Shantz of the University of Arizona, and Dr. William Trelease of the University of Illinois. The arboretum now contains over 3,000 specimens of plants, many native to the Southwest desert country, a large number from foreign countries, and about 600 added within the past year. F. J. Crider is director of the arboretum, with Fred Gibson and Palmer Stockwell as assistants.

Survey of Philippine Experiment Stations.—According to a note in *Planter and Sugar Manufacturer*, a survey of the agricultural experiment stations in the Philippines is to be carried on with a view to strengthening the work of these institutions. One phase to be investigated is the question of restricting a station to a single field of inquiry. H. Atherton Lee, director of research for the Philippine Sugar Association, has been recommended to carry on this survey.

Guggenheim Fellowships in Agricultural Science.—The 1929 awards of fellowships of the John Simon Guggenheim Memorial Foundation include among the 49 new appointments Dr. Samuel Brody, associate professor of dairy hus-

bandry in the University of Missouri and associate dairy husbandman in the Missouri Station, for researches on the kinetics of growth and senescence with special reference to phyothermy in ruminants, and the preparation of a comprehensive monograph on the kinetics of growth and senescence, and Dr. Jonas J. Christensen, assistant professor in the University of Minnesota and assistant plant pathologist in the Minnesota Station, for a study of the genetics of physiologic forms of certain fungi pathogenic to crop plants. This work is to be done chiefly in Germany. A fellowship previously granted to Dr. Warren K. Stratman-Thomas, research pharmacologist in the University of Wisconsin, was renewed for a continuation of his clinical trial in Africa of certain new arsenical compounds in the chemotherapy of trypanosomiasis.

Industrial Fellowships of Mellon Institute, 1928–29.—A list recently issued of the approximately 200 industrial fellowships in operation at this institute during the current year includes in subjects related to agricultural science the following: Fertilizers, H. H. Meyers; insecticides, O. F. Hedenburg; and cereal and milk products, R. R. Irvin.

Oberly Memorial Fund Bibliographies.—Awards have recently been announced in the biennial contest sponsored by the Eunice Rockwood Oberly Memorial Fund Committee of the American Library Association (E. S. R., 50, p. 900) for the best bibliography in agriculture or the natural sciences. Nine bibliographies were considered in this contest, and first place was awarded to Annie M. Hannay of the library of the U. S. D. A. Bureau of Agricultural Economics for her bibliography entitled Control of Production of Agricultural Products by Governments. Honorable mention was given to Margaret T. Olcott of the same library for a bibliography entitled Taxation and the Farmer and to Carrie B. Sherfy and Nell W. Smallwood of the Bureau of Dairy Industry for a joint bibliography entitled Ice Cream. "Very favorable mention" was also made of an author and subject index on plant pathology compiled by Jessie W. Allen, librarian of the Bureau of Plant Industry.

International Congresses in 1930.—Among the international congresses to meet abroad in 1930 are the following:

The Fifth International Botanical Congress is to meet at Cambridge, England, August 16–23, with excursions during the following week. The secretaries are Dr. F. T. Brooks, 31 Tenison Avenue, Cambridge, and Dr. T. F. Chipp, Royal Botanic Gardens, Kew.

The International Congress of Soil Science will meet at Leningrad, U. S. S. R., June 1–10 (dates still provisional). The American representative is Dr. A. G. McCall, U. S. D. A. Bureau of Chemistry and Soils.

The World's Fourth Poultry Congress is to be held in the Crystal Palace, London, July 22–30. The chairman of the subcommittee for the United States is Harry R. Lewis, East Greenwich, R. I.

The Ninth International Horticultural Congress is scheduled to meet in London, August 7–15. The representative of the American Pomological Society is W. T. Macoun, Central Experimental Farm, Ottawa, Canada.

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
U. S. GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
10 CENTS PER COPY
SUBSCRIPTION PRICE, 75 CENTS PER VOLUME
OR $1.50 PER YEAR

▽

EXPERIMENT STATION RECORD

Vol. 61 AUGUST, 1929 No. 2

The steady multiplication of professional organizations interested in the promotion of some phase of agricultural education and research and their tendency in recent years to meet with increasing frequency in the National Capital brings to Washington each year many groups of these workers. Not rarely the various gatherings have more or less in common and joint sessions add to the profitability and enjoyment of their stay. Others meet independently and come and go without formal contacts. One and all, however, contribute in their own time and way to the advancement of agriculture, and register more or less positively and distinctively their individual impress upon the Capital City and the national life.

During the months of May and June, at least three such gatherings of considerable general interest met in Washington. The first of these, chronologically speaking, was the Agricultural Libraries Section of the American Library Association, which met on May 13 and 15 as a part of the annual convention of the parent body. The second was the Third National Boys' and Girls' 4-H Club Camp, which continued from June 19 to 25 and was followed immediately by the annual meeting of the American Dairy Science Association from June 26 to 28.

Despite the fact that this triumvirate of agricultural workers was perhaps as diverse as regards membership and immediate objectives as could readily be visualized, all were welcome visitors to the Department of Agriculture, where each group made or renewed contacts with those directly or more remotely associated with its work. The meeting of library workers was naturally sponsored by the staffs of the Department Library and its branches and the 4-H camp by the Office of Cooperative Extension Work, while the Bureau of Dairy Industry was the immediate host of the American Dairy Science Association. In no case, however, was interest restricted along bureau lines, and attendance at the various sessions and participation in other activities was well-nigh as comprehensive as the field of the Department itself.

The Agricultural Libraries Section, as its name indicates, is a group composed of the representatives of the various libraries in the United

LIBRARY
TNAU, Coimbatore - 3

States and Canada specializing in the field of agricultural publications. Its membership, therefore, includes, among others, representatives of the Department Library and its branches, the agricultural colleges and experiment stations, and similar institutions. It was organized late in 1911, following an enlightening discussion of the experiment station library at the convention of that year of the Association of Agricultural Colleges and Experiment Stations. Since its formation the section has functioned quietly but effectively. As a recent summary of its work sets forth, it has to its credit "a considerable number of papers on the problems of agricultural libraries which are a useful addition to the literature of library economy; it has been responsible for the publication of the Agricultural Index; it has helped to make agricultural librarians and libraries better known and thus enabled them to cooperate better in their work; and finally it has helped, at least to some extent, the development of agricultural libraries and promoted agricultural bibliographical work."

The Washington meeting of the section was attended by representatives of the agricultural colleges of 21 States, the U. S. Department of Agriculture, and others to a total of about 100. The program had been arranged to center around the subject of the relationships between the Department and the agricultural libraries of the country, and was opened by a discussion of this general theme by Miss Claribel R. Barnett, librarian of the Department. In this paper, Miss Barnett dwelt especially on the opportunities for coordination, cooperation, and close relationships. Admitting that "administrative supervision at a central point under present conditions seems entirely out of the question," the advantages of voluntary cooperation and the formulation of a general policy were set forth.

The resources of the Department Library, with its more than 210,000 volumes, its current receipts of 3,600 periodicals and an equal number of proceedings, reports, and similar material, its catalog cards of approximately 600,000 entries, supplemented by about 500,000 additional cards in special indexes of the various bureaus, and the extensive bibliographical assistance available were described as open to research workers of sister institutions. Additional service which might be rendered with adequate funds was also discussed, including such projects as the extension of exchanges of duplicates and the preparation of printed cards for all of the experiment station publications. The feasibility of organizing such undertakings through small contributions by the States was mentioned, as well as the possibility of enlarging the combined resources of the Nation's libraries by greater specialization of the various States under a plan whereby each agricultural college would endeavor to build up in its

library a relatively complete collection of material pertaining to one or two of the State's principal commodities, as sugarcane and rice in Louisiana and citrus fruits in Florida and California. Presumably, these collections would be generally available for consultation by specialists working in the respective fields. The resources of other institutions would thereby be conserved and the time and convenience of workers measurably benefited.

The ensuing discussion revealed much interest in the suggestions of Miss Barnett, and in an effort to promote their realization in concrete form, a committee on relationships was appointed. This committee is headed by Mr. Charles A. Brown, librarian of the Iowa State College, and includes in addition to Miss Barnett the librarians of the colleges of agriculture of Louisiana, Oregon, and Missouri.

The second session of the section was devoted to the consideration of a wide range of topics. Among these may be mentioned as illustrative of the scope of the section's interest such technical matters as the exchange of duplicates, the mechanics of interlibrary loans, including their extension to theses and manuscripts, the purchase of books and periodicals from experiment station funds, the preparation of a union list of periodicals on file in the land-grant colleges, and the printing of cards for articles in agricultural encyclopedias. Many of these topics involve cooperative relationships, and a report was presented from the only standing committee of the section, that on bibliographical aid, which brought out the fact that the committee had prepared as its year's work a monthly list of references to rural life literature as found in books, pamphlets, and periodicals for publication in *Rural America.* A further discussion of cooperative bibliographical work indicated that under a tentative plan for such cooperation between the States and the Department source books of agricultural statistics have been compiled for the States of Alabama, Oklahoma, and California, and that lists of sources of such statistics have been prepared in Oregon, Idaho, and Maryland. The details of this cooperation varied considerably in the different institutions, but it is evident that its possibilities are receiving attention as never before.

Another matter of considerable general interest was a suggestion for a future meeting of the section at the time of the annual convention of the Association of Land-Grant Colleges and Universities. No definite action was taken on this proposal, and some little time may be required to secure a satisfactory arrangement of program and a working out of other details. Since the section and certain groups of the association have numerous interests in common, it would seem that some useful contacts might be established in this way, and that an occasional meeting of the sort, actively supported by the appropriate sections, would deserve encouragement.

The National 4-H Club Camp, held for the third year on the Department grounds, is no longer an innovation, but is rapidly becoming an established event in the Department's June routine. In many ways the latest encampment was regarded as the most successful of the series.

The outstanding feature of this camp was the active and sustained interest manifested in the movement by Mrs. Herbert Hoover. Originally scheduled to speak to the boys and girls over the radio in a coast-to-coast broadcast following their club banquet, Mrs. Hoover also made an informal visit and inspection of the camp itself, and after a brief address presented the trophy cups offered by the Secretary of Agriculture to the most typical boy and girl member in attendance. On the final day she received all club delegates and their leaders in the East Room of the White House, supplementing the customary reception earlier in their stay by President Hoover in the Executive Offices. These repeated contacts not only contributed greatly to the enjoyment of those in attendance, but served to focus public attention to an unusual degree on the whole 4-H club undertaking as a national enterprise of large significance.

Like its predecessors of 1927 and 1928, the camp assembled a selected group of boys and girls from the various States for about a week of addresses, sightseeing, camp life, and similar activities. Representation from each State was limited to not to exceed four club members and two leaders from the State extension staff. As in 1928, 39 States were represented, and as a newcomer the Territory of Hawaii.

The program was skillfully arranged to blend instruction, demonstration, patriotic inspiration, and entertainment. Advantage was also taken of the opportunity for special conferences of club leaders. A novel feature was a complete exhibit of club "house organs" and of State extension house organs with 4-H club departments. The final event was a national 4-H club pageant.

Despite the fact that the necessary limitation of the encampment as to numbers makes mathematically impossible participation by the vast majority of the club members as a whole, now aggregating over 600,000, and doubtless results in the elimination of a large number with excellent records and of great worthiness, the idea of an annual gathering of State representatives seems to have been a happy conception. With increasing experience the camp gains in attractiveness year by year, and its unique privileges constitute a reward to be earnestly sought for and long appreciated if secured. Presumably the possibility of attainment of the honor adds zest to the routine of many of the clubs, encourages persistence, and stimulates outstanding work. Particularly valuable to both the individual and

the Nation is the emphasis thereby placed upon personal responsibility and achievement, for as Mrs. Hoover said in her radio address, "the bearing of responsibility is naturally much easier if one has grown gradually into it and has had the execution of smaller responsibilities than if the burdens are suddenly dropped upon inexperienced shoulders." It is in such more or less intangible ways, as well as by its direct service in the dissemination through the rising generation of improved methods of agricultural practice and household economy, that the 4-H club work is making a distinctive and effective contribution to the national welfare.

The American Dairy Science Association is a comparative stranger to Washington, as a large proportion of its meetings have been arranged to synchronize with the National Dairy Show. It is, however, an organization with several hundred members and over 20 years of achievement.

The association has been known by its present name since 1916. following an initial year as the National Association of Dairy Instructors and Investigators and about a decade as the Official Dairy Instructors Association. Originally its membership was restricted to instructors and investigators in agricultural colleges, experiment stations, and Government dairy divisions in the United States or Canada who were dealing with the production or handling of milk or the manufacture or sale of dairy products. In 1920 it absorbed the Association of Extension Workers in Dairying, and its revised constitution adopted in 1925 made provision for active membership for "anyone filling a responsible position connected with the dairy industry and who has had a college or university training in technical science or anyone filling a responsible position in the industry of a professional character requiring a technical knowledge of dairying of a high order." Dairy specialists in the agricultural colleges and experiment stations, however, have continued to constitute a large proportion of its membership, and at the recent meeting about two-thirds of the papers came from the agricultural college and station personnel and the remainder from members of the Department of Agriculture and commercial fields.

The association was welcomed to the Department by Dr. A. F. Woods, director of scientific work, and an explanation of the functions, work, and progress of the Bureau of Dairy Industry was presented by its chief, Mr. O. E. Reed. The presidential address, given by Mr. G. C. White, outlined the history, scope, and outlook of the association, the object of which is to "advance the general welfare of the dairy industry, especially by the improvement of dairy instruction, by the stimulation of scientific research in all phases of the

subject, and by improvement in methods of conducting extension work."

The meetings were organized into sections of dairy production, dairy manufactures, and dairy extension. The number of papers was large, and since many exceeded their allotted time limit the opportunity for discussion was somewhat restricted. The chief item of business was in connection with a motion to compile a uniform standard milk ordinance, but this was eventually tabled on the ground that such action was beyond the scope of the organization.

The papers in the production section dealt with the value of minerals in the rations of dairy animals, the influence of rations on the producing ability of cows, the value of grinding roughages, self-feeders for wintering heifers, and growth in dairy heifers. The nutritional value of raw and pasteurized milk, flavor of milk, buffer action of milk, relation of temperature to changes in milk, and the excretion of ovarian hormones during pregnancy were also discussed in this section, and other papers presented some of the economic aspects of the dairy industry and the value of photographs in breeding and type investigations.

In the dairy manufactures section the papers dealt with the determination of fat and the control of color of concentrated milks, their influence on the texture and flavor of ice cream, and their place in the diet; the keeping qualities and the changes in the microflora of storage butter; observations on the making of washed curd and process cheese, and the influence of composition to quality of cheese; and the utilization of various flavors, amount and quality of gelation, and the influence of aging and homogenization of mixes on ice cream. A comparison of various methods of counting bacteria for grading raw milk, the action of proteolytic enzymes, ropy milk, the foaming of milk, and the rennet coagulation of milk from individual cows; the estimation of fat and phospholipins, and the effect of heat on the stability of buttermilk; chemical changes in frozen milk; and the relation between the fat and protein of milk were other subjects taken up in this section.

In the extension section dairy herd improvement associations, 4-H calf club work, bull associations, cooperative creameries, and proved herd sires work composed the subject matter of most of the papers.

The total attendance exceeded 250, drawn from all parts of the country. This attendance was the largest in the association's history and evidently exceeded expectations, causing more or less congestion at certain sessions and doubtless being responsible for the serious shortage of printed programs. There were many other evidences of interest in the association and its work, and the results of the meeting were deemed very encouraging.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

[Agricultural bacteriological chemistry] (*Wisconsin Sta. Bul. 405 (1929), pp. 25, 26*).—Work of the station on the use of reactions induced by the growth of various organisms for the production of commercially valuable compounds is very briefly summarized.

Results of fermentation research.—Fermentation methods for the production from corn of acetone, ethyl alcohol, and butyl alcohol, and studies of butyric acid and propionic acid-producing bacteria are mentioned in this study by E. B. Fred and W. H. Peterson, together with an investigation of the fermentation possibilities of the pentoses, amounting to from 35 to 65 per cent of the total sugars produced in the hydrolysis of wood shavings and sawdust, which remain unattacked after the ethyl alcohol fermentation of the hydrolysis products of wood wastes. From 1 ton of the wood there have thus far been obtained from 12 to 68 lbs. of acetic acid and from 84 to 205 lbs. of lactic acid in addition to a yield of from 59 to 149 lbs. of ethyl alcohol resulting from the yeast-induced fermentation. Some such source of available nitrogen as blood meal, tankage, or malt sprouts, together with an excess of calcium carbonate, was found essential to the success of the fermentation.

The action of certain lactic and butyric acid bacteria.—Under this head a study by W. H. Peterson, E. B. Fred, and L. M. Pruess, of the action of these organisms on proteins is briefly noted, together with the nitrogen-fixing abilities of some of the strains examined. In the action on proteins but little ammonia was produced, though there was a large production of amino acids and other nonprotein nitrogen compounds.

In the nitrogen fixation studies by E. B. Fred, E. McCoy, and W. M. Higby great variations among the strains were observed. The butyl alcohol producers fixed in general comparatively little nitrogen, "but the true butyric acid-forming organisms, 33 strains of which were studied, are more effective, many of them being able to assimilate as much as 2 to 3.5 mg. of nitrogen per 100 cc. of culture."

Flour chemistry investigations (*Kansas Sta. Bien. Rpt. 1927–28, pp. 55, 56*).—The strength of a flour gel was found to run parallel with the baking strength of the flour. Preliminary results indicate that the lecithin content increases the colloidal properties of a flour and thus has a very beneficial effect on the baking qualities.

The alkaline decomposition of cystine, J. C. Andrews (*Jour. Biol. Chem., 80 (1928), No. 1, pp. 191–210*).—From a briefly noted analysis of previously published work on the decomposition of cystine in alkaline solutions, as listed by Hoffman and Gortner (E. S. R., 47, p. 310), the author reaches the conclusion, among others, that "the general practice of heating the cystine for some hours in the solution of alkaline plumbite accelerates these reactions to the extent of making an individual scrutiny of them impossible," and describes in his present communication from the University of Pennsylvania Medical

School a series of experimental studies carried out for the most part at 25° C. "The lower temperature makes it possible to follow more completely the course of the individual reactions."

Precipitants of the sulfide ion other than lead (as acetate), which were employed in this work and studied with reference to their effect upon the rate of formation of certain of the decomposition products of cystine in alkaline solution, were copper as sulfate and as metal, iron added as ferric chloride, zinc as the acetate, and arsenic in the form of disodium arsenate. The rates of production of ammonia and of sulfide ion were among the data sought; the rate of racemization of cystine in the alkaline solutions used was determined polarimetrically; and, to permit the calculation of the concentration of the sulfide ion possible in the reaction mixtures, the lead-ion concentrations of alkaline solutions saturated with lead hydroxide were determined by measurements of the potentials of the lead in alkaline lead hydroxide half cell joined to a calomel half cell of the saturated type.

The rate of alkali racemization of cystine was found much greater than the decomposition rate. The deaminization rate, measured under a variety of conditions, was greatly increased by the presence of lead sufficient to precipitate all the sulfur as lead sulfide. It was much less affected by copper salts and unaffected by metallic copper, the salts of zinc, iron, and arsenic used having practically no effect. The presence of lead markedly accelerated the liberation of sulfide ion from cystine and cysteine, the other sulfide ion precipitates used showing from much less influence to none at all. The optical configuration of the cystine was found to be without influence upon the rate of loss of ammonia under the conditions of the experiments described.

The conclusion, among others, is reached that "the ease with which the production of sulfide can be varied by the conditions employed shows the futility of the old classification of 'easily split sulfur' unless conditions are very definitely controlled and described."

A nonspattering semi-automatic wash bottle, N. S. Serinis (*Chemist-Analyst, 17 (1928), No. 1, pp. 15, 16, figs. 2*).—The jet tube of this device instead of being extended directly to the bottom of the wash bottle flask is bent back in a narrow U-shape, emerging a little above the top of the stopper through a second hole. A third hole in the stopper carries a straight tube reaching nearly to the bottom of the flask, extending slightly above the top of the stopper like the reverse bent jet tube, and connected with the jet tube by a short arch of rubber tubing which must be narrow enough to form a kink at the top of the bend. The air inlet tube is of the usual form and is provided with a Bunsen valve (a short piece of rubber tubing plugged at the lower end and with a slit or with two opposite slits in the side).

A slight pressure applied vertically downward at the kink, air pressure having been provided in the flask, permits the use of a delivery ranging from drops to the full capacity of the jet without blowing while using the bottle. The automatic closing of the kink valve is claimed entirely to prevent dripping and spattering.

Preparation of stable ammonium molybdate solution, J. P. Mehlig (*Chemist-Analyst, 17 (1928), No. 4, p. 6*).—To prepare an ammonium molybdate-nitric acid solution which may be held indefinitely without the formation of the usual annoying precipitate, the author of this note from the Oregon State College recommends passing the solution of molybdic acid in ammonia very slowly from a separatory funnel used as reservoir through a filtering funnel with paper, delivering into a thistle tube the end of which dips under the surface of the nitric acid (sp. gr. 1.2) required to complete the reagent. The

nitric acid solution is to be agitated continuously throughout the addition of the molybdate and for from 2 to 3 hours afterwards by means of an air current blown in at the bottom of the solution. The solution so prepared was found permanent for at least several months.

Analysis of phosphate rock, F. KAPSHULL (*Chemist-Analyst, 17 (1928), No. 1, p. 11*).—The following procedure is prescribed without comment, as here stated:

Phosphorus.—Put in a 400-cc. beaker and add 2 cc. HNO_3 concentrated and 20 cc. concentrated HCl. Put on hot plate and bring to dryness. Dissolve in 30 cc. HCl 1–1. Boil, filter, and wash with 1–1 HCl and water perfectly hot. The residue here is silica. To the filtrate add 50 cc. solution No. 1—220 gm. citric acid, 800 cc. NH_4OH, and 1,200 cc. H_2O; 50 cc. solution No. 2—110 gm. $MgCl_2$, 210 gm. NH_4Cl, 700 cc. NH_4OH, and 1,200 cc. H_2O (always filter No. 2 solution before adding); and 30 cc. NH_4OH. Stir and allow to cool for one-half hour, filter, and wash with NH_4OH 1–3. Burn residue and weigh as $Mg_2P_2O_7$. Weight times factor 27.86 equals the percentage of phosphorus.

Lime.—Weigh 0.5 gm. and dissolve in 30 cc. 1–1 HCl. Boil and bring into solution. Add 1 gm. sodium acetate and 30 cc. of water and boil again (if solution does not smell of acetic acid, add more sodium acetate). To filtrate add 5 cc. acetic acid and excess of ammonium oxalate, boil, filter, and save *filtrate. Wash precipitate with hot water until free of ammonium oxalate* (test filtrate to make sure that no lime is left). Place residue in same breaker, fill one-half full with cold distilled water, and add 10 cc. concentrated H_2SO_4, bring to boil, and titrate with N/10 $KMnO_4$. To obtain the percentage of CaO *the following equation should be used:*

$$\frac{0.4167\times200}{\text{cc. KMnO}_4}=\%\ \text{CaO}$$

Magnesia.—To filtrate from above add 30 cc. NH_4OH, stir, and allow to settle for one-half hour. Burn residue as $Mg_2P_2O_7$. To obtain percentage, 72 times the weight equals the percentage of MgO.

The determination of formic acid in acetic acid, F. G. GERMUTH (*Chemist-Analyst, 17 (1928), No. 1, p. 7*).—The following procedure is described as having given the author consistently accurate results in the determination of *formic acid present as an impurity in acetic acid and in other substances.*

Of acetic acid (99.5 per cent) add a 2-gm. sample to 20 cc. of 4 per cent mercuric chloride and 20 cc. of a 15 per cent solution of pure crystalline potassium acetate in a 500-cc. Erlenmeyer flask. Add further, to catalyze the reaction, 1 cc. of a 2 per cent solution of hydroxylamine hydrochloride. The hydoxylamine salt is credited with having a tendency to prevent reduction by sulfurous acid, if present, as well as with an accelerating influence on the reduction of the mercuric chloride by the formic acid. Heat the reaction mixture at 50° C. for one hour and filter off, dry, and weigh the precipitated mercurous chloride. Calculate formic acid from the weight of the precipitate by means of the factor 0.0977.

This method is considered preferable to the procedure ordinarily employed for determining formic acid. It has been found quicker, while at the same time it eliminates the condenser flask and is not interfered with by the presence of sulfates.

The determination of maltose and glucose, W. BRAUN and B. BLEYER (*Ztschr. Analyt. Chem., 76 (1929), No. 1–2, pp. 1–38*).—This paper presents the results of an extensive experimental investigation of the applicability of the cuprimetric methods, the iodometric determination, methods dependent on the

reduction of alkaline solutions of mercuric salts, permanganate oxidimetric procedures, etc., to the estimation both of maltose and of glucose separately and to that of hotb sugars in mixtures of the two.

The paper contains the subdivisions (1) introduction, (2) reduction of Fehling's solution by pure glucose (including a brief account of the purification of glucose), (3) the reduction of Fehling's solution, alkaline mercury solutions, and alkaline iodine solutions by pure maltose solutions (this section gives full detail of the preparation from starch and the purification and analysis of the maltose used as well as the analytical data indicated in the caption), (4) the reduction of Fehling's solution by mixtures of glucose and maltose, (5) the reduction of Barfoed's solution by mixtures of glucose and maltose together with inversion methods, and (6) solutions used and description of work. Tables showing the reduction of N/10 permanganate in cubic centimeters and of copper in milligrams for glucose, for maltose, and for each in a mixture of the two are also given.

The reduction of hypo-iodite solutions was practically stoichiometric for each of the two sugars investigated.

METEOROLOGY

The weather of 1928 in the United States, A. J. Henry (*U. S. Mo. Weather Rev., 56 (1928), No. 12, pp. 509, 510, pls. 2*).—It is stated that the record of the year was a favorable one "so far as the average distribution of temperature and precipitation, the two elements upon which success or failure in crop production greatly depend, are concerned. . . . The mean annual temperature for the greater part of the country was above the normal, especially in the Plains States from the Dakotas to the Gulf of Mexico. . . . For the United States as a single geographic unit precipitation was close to the normal, some districts, the East Gulf States, the Atlantic seaboard south of New England, the States of Kansas, Missouri, Iowa, Oklahoma, and parts of the surrounding area received greater than the normal rainfall. Large areas in the Ohio Valley, the West Gulf States, the plateau region west of the Rockies, and the Pacific Coast States received less than the normal.

"The weather of the year was conditioned upon the frequency and intensity of extra tropical cyclones and anticyclones which traversed continental United States. The excessive precipitation along the Atlantic seaboard was due to the passage of two tropical cyclones in very nearly the same path. One of these caused great destruction of property and large loss of life in Florida. . . . One hundred and sixty-one tornadoes, great and small, were reported during the year. The Rockford, Ill., tornado of September 14 caused a loss of life of 14 and the injury of 100 persons, this being the greatest casualties in any single storm."

Climatological data for the United States by sections, [November–December, 1928] (*U. S. Dept. Agr., Weather Bur. Climat. Data, 15 (1928), Nos. 11, pp. [194], pls. 3, figs. 2; 12, pp. [199], pls. 2, figs. 3*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for November and December, 1928.

Meteorological observations, [January–February, 1929], C. I. Gunness and L. O. Jones (*Massachusetts Sta. Met. Buls. 481–482 (1929), pp. 4 each*).—The usual summaries and notes are given of observations at Amherst, Mass., during January and February, 1929.

Report of the chief of the Weather Bureau, 1927–28 (*U. S. Dept. Agr., Weather Bur. Rpt. 1928, pp. V+253, pls. 7*).—In addition to brief comments on

meteorology in aid of aviation and marine meteorology, which were two of the major activities of the Bureau during the year, this report gives a general summary of weather conditions of each month of 1927, monthly amounts of sunshine at 163 stations, details of excessive precipitation during the year, and tabulations of data for pressure, temperature, precipitation, humidity, cloudiness, wind, and evaporation throughout the United States.

"The outstanding event associated with the weather of the year was the great flood in the Mississippi River and some of its tributaries during the spring months, brought about mainly by heavy rains over portions of the watershed during March and April. The total area overflowed is estimated as nearly 30,000 square miles, the number of lives lost as slightly more than 200, and property damage of all kinds as more than $350,000,000, marking it as one of the greatest disasters ever experienced in the history of the country. . . . Tornadoes were unusually numerous during the year and damage to property set a new high record for these storms, and the total number of deaths, slightly less than 550, has been exceeded only in a few other years. The estimated property loss from these storms is set at more than $40,000,000, about $25,000,000 of which resulted from the single storm that passed over portions of St. Louis, Mo., and near-by areas of Illinois on September 29. . . . Despite the general coolness of the summer, the growth of vegetation was mainly satisfactory; even the corn crop, much delayed by continued coolness, matured satisfactorily due to the general warmth of the early autumn months and the unusually late appearance of the first killing frosts."

Monthly Weather Review, [November–December, 1928] (*U. S. Mo. Weather Rev., 56 (1928), Nos. 11, pp. 435–484, pls. 11; 12, pp. 485–528, pls. 13, figs. 13*).—*In addition to detailed summaries of meteorological and climatological* data and weather conditions for November and December, 1928, and bibliographical information, notes, abstracts, and reviews, these numbers contain the following contributions:

No. 11.—Fog and Haze, Their Causes, Distribution, and Forecasting, by H. C. Willett (pp. 435–468).

No. 12.—A Critique on the Construction and Use of Minimum-Temperature Formulas (illus.), by E. S. Ellison (pp. 485–495); Upper-Air Currents at Honolulu, T. H. (illus.), by A. Thomson (pp. 496–498); Blue-Sky Measurements at Apia, Samoa, by A. Thomson (p. 499); Seventeen-Year Record of Sun and Sky Radiation at Madison, Wis., April, 1911, to March, 1928, Inclusive (illus.), by A. F. Piippo (pp. 499–504), with discussion by H. H. Kimball (p. 504); Commercial Airways Weather Service—Present Status and Future Prospects (illus.), by W. R. Gregg (pp. 505–509); and The Weather of 1928 in the United States (illus.), by A. J. Henry (pp. 509, 510) (see p. 110).

SOILS—FERTILIZERS

[Soil Survey Reports, 1923 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils, Adv. Sheets Field Oper. Bur. Soils, 1923, pp. IV+959–1012, pls. 2, fig. 1, map 1; [Soil Survey Rpts.], Ser. 1923, Nos. 32, pp. 1043–1093, fig. 1, map 1; 35, pp. 1161–1181, fig. 1, map 1; 38, pp. 1223–1265, pls. 2, fig. 1, map 1*).—This group of reports for the 1923 series covers the surveys of Olmsted County, Minn. (published without serial number); Lycoming County, Pa.; St. Marys County, Md.; and Henderson County, Tex.

Soil Survey of Olmsted County, Minnesota, J. A. Elwell et al.—Olmsted County, southeastern Minnesota, contains 426,240 acres of an undulating to rolling plain, well dissected by drainage valleys, and has good drainage to five main streams. Its soils are "well adapted to general farming."

Tama silt loam occupies 28.6 per cent of the total area of the county, Carrington silt loam 21.6 per cent, and Clinton silt loam 11.9 per cent. In all, 32 classified soil types were found to be represented and are here assigned to 17 series. Small areas of rough stony land, aggregating but 2.5 per cent of the surface surveyed, and 0.7 per cent of muck constituted the unclassified soil material found.

No. 32. *Soil survey of Lycoming County, Pennsylvania*, E. H. Stevens et al.—This county occupies an area of 787,840 acres in the north-central part of the State and comprises topographic features both of the ridge belt and of the Allegheny Plateau of the Appalachian system. "Natural drainage is well established and all parts of the county are well watered." Lycoming County is mountainous, however, with 23.6 per cent of rough stony lands.

The presence of 40 types classified as 15 series, Dekalb stony sandy loam leading in areal extent with 12.2 per cent, indicate the varied character of the arable soil area. The survey was made in cooperation with the Pennsylvania College and Station.

No. 35. *Soil survey of St. Marys County, Maryland*, *S. O. Perkins*.—St. Marys County, southern Maryland, consists of 237,440 acres of the remnants of a plain originally smooth but now dissected by a great number of small valleys. Meadow areas, tidal marsh, and some of the terrace soils have poor drainage, but the remaining land has from good to excessive drainage.

Of 13 types representative of 5 series of classified soils, the more extensive are Leonardtown silt loam 17.7 per cent, Sassafras silt loam 17.1 per cent, Sassafras gravelly loam 12.2 per cent, Keyport silt loam 10.7 per cent, and Sassafras loam 10.6 per cent, while a total of 6.5 per cent of the area of the county consists of the unclassified groups of tidal marsh, meadow, and coastal beach. This survey was made in cooperation with the Maryland Geological Survey and the Maryland Experiment Station.

No. 38. *Soil survey of Henderson County, Texas*, H. W. Hawker and R. E. Devereux.—Henderson County, east-central Texas, comprises an area of 605,440 acres of a plain of general but varying dissection, least deep and thorough in areas of deep sand. Sand hills in the southern part of the county and mountains in the eastern part are noted as the most prominent topographic features. Poor drainage occurs in the more nearly level northwestern and western parts of the county.

A total of 22 soil series represented by 33 types were found in the survey here reported, Susquehanna fine sandy loam 27.9 per cent, Norfolk fine sand 27.2 per cent, and Ochlochkonee fine sandy loam 10.5 per cent being the more extensive types. Unclassified peat, 0.2 per cent, was also found.

This survey was made in cooperation with the Texas Experiment Station.

[Soil Survey Reports, 1924 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1924, Nos. 4, pp. III+97–124, fig. 1, map 1; 15, pp. 38, pls. 3, fig. 1, map 1*).—Of the reports of the 1924 series those covering the surveys of Chattahoochee County, Ga., and of the Auburn area, California, are here noted.

No. 4. *Soil survey of Chattahoochee County, Georgia.*, E. W. Knobel et al.—Chattahoochee County consists of 158,080 acres of undulating or rolling to very hilly land in west-central Georgia. In general, the surface is more or less eroded and gullied in the hilly and rolling areas, and badly broken and hilly in the southeastern part of the county. The drainage is furnished entirely by the Chattahoochee River and its tributaries.

In order of their extent the soil areas found in Chattahoochee County consist of Norfolk sand, 25.1 per cent; 17.4 per cent of unclassified lands, comprising

meadow 9.3 per cent and rough, gullied land, 8.1 per cent; Ruston sandy loam, 10.5 per cent; Susquehanna sandy loam, 10.0 per cent; and others of small areal importance, making a total of 14 series, including 26 types, together with the unclassifiable lands noted.

This survey was made in cooperation with the Georgia State College of Agriculture.

No. 15. *Soil survey of the Auburn area, California*, S. W. Crosby et al.—The Auburn area of California has a surface extent of 391,040 acres in the north-central part of the State, containing the western half of Placer County and a small part of Nevada County. The physiographic features of the Auburn area are those of the three distinct divisions of (1) the Sacramento Valley, (2) the lower foothill range, and (3) an upper foothill and mountainous section. Drainage is good in the two latter divisions, but hardpan has interfered with good natural drainage in certain areas of the valley division.

The most extensive of the 22 soil types of 18 series found in the survey of the Auburn area as here reported are Aiken clay loam 12.0 per cent and Holland sandy loam 11.1 per cent. Rough stony land 3.8 per cent, rough mountainous land 20.0 per cent, placer diggings 1.4 per cent, scabland 4.6 per cent, and riverwash 0.2 per cent constituted the areas not classified.

This survey was made in cooperation with the California Experiment Station.

The soils of Michigan: Grayling sand, M. M. McCool and A. G. Weidemann (*Michigan Sta. Spec. Bul. 180 (1929), pp. 24, figs. 5*).—This is the first of a series of reports on the agricultural possibilities and treatment needs of Michigan soils.

The Grayling sand type, popularly known as Jackpine sand, is described as covering about 3,000,000 acres in north-central Michigan. It was found in the work here reported to be low in organic matter, rather porous, of a low water-holding capacity, low in available potassium and phosphorus, and acid in reaction throughout its profile. At Grayling it showed very low crop-producing power until plant food was applied liberally. The more effective treatments consisted of lime, stable manure with lime, and stable manure with phosphate. Commercial fertilizers were of little value except when used in conjunction with organic matter.

Heavy rolling or packing was found a necessary preparation for the seeding of any crop, and the soil showed itself subject to such an extent to wind erosion that fall and early spring protection of crops by such coverings as stubble or fall seeded rye were found practically indispensable.

Details of experimental cultural practices and data obtained in plat experiments covering a rather wide range of crops are given. "The most successful crops have been corn, sunflowers, turnips, rutabagas, alfalfa, sweet and mammoth clover, rye, and potatoes." An appendix presents in 17 tables crop yield data in detail for experiments of the years 1921–1927.

As a final conclusion it is considered "doubtful if under present economic conditions the utilization of land of the Grayling sand type for general farming purposes is warranted," the type being unproductive and its improvement having proved to involve a considerable outlay of capital.

Soil reconnaissance of the Panama Canal Zone and contiguous territory, H. H. Bennett (*U. S. Dept. Agr., Tech. Bul. 94 (1929), pp. 47, pls. 5, figs. 4, map 1*).—The Canal Zone area of which the soil survey is here reported has an extent of 547,200 acres and is topographically characterized by comparatively steep slopes both to the Atlantic and to the Pacific oceans, with an extremely hilly lowland belt at the foot of the Atlantic slope. "Generally, the numerous hills are not high, but most of them are steep, so that the

land physically suited to agriculture is probably not much more than 20 per cent of the total area, and not all of this represents good soil."

The soils found in the survey here reported include Arraiján clay 34.3 per cent, Gatun clay 20.5 per cent, and Frijoles clay 13.1 per cent of the total area examined, together with less extensive areas to a total of 10 types, each representing a separate series as here classified. The unclassified areas of limestone hills comprise 2.7 per cent, marsh 2.8 per cent, alluvium 4.4 per cent, and fills and excavated areas 1.5 per cent of the total land surface of the zone. The usual descriptions of individual types and a type distribution map accompany the report.

[**Causes of soil acidity**] (*Wisconsin Sta. Bul. 405 (1929), pp. 104, 105*).—Soil acidity is attributed by E. Truog, W. H. Kerr, and J. A. Chucka to an alumino-silicic acid which has been isolated from bentonite and from soils. Base exchange also is considered a property of this compound, and the properties of swelling, granulation, and cracking of soils are believed to be due to the water absorbent power and the great shrinkage on drying of calcium and magnesium alumino-silicates.

"When the compound exists as the free acid, or as the sodium salt, it disperses readily and goes into a colloidal solution when in contact with water. In this latter condition it may be leached out of soils, and when this takes place the soil 'runs' and becomes puddled. The compound is completely dispersed or mixed with all the colloidal material of soils. When the compound coagulates, the contracting force is so strong that it causes a coagulation of all the intermixed material. If all of this acid is washed out of a soil no acidity remains, even though no lime may be present. This explains why some soils in regions of great rainfall never become sour, although tests show no lime present.

"The compound exercises a controlling influence on the physical and chemical properties of soils. It reacts physically and chemically with great rapidity even though it does not go into true solution. The method of preparing large amounts of this material from soils and bentonites has been perfected, and this will make possible a thorough and complete study of the properties of the compound and its function in soils."

A study of the soil solution as governed by H-ion concentration (*Kansas Sta. Bien. Rpt. 1927–28, pp. 29, 30*).—Progress of the experimental work in directions similar to those previously indicated (E. S. R., 56, p. 811) is recorded.

In general it has been found that the same amount of iron, calcium, magnesium, potassium, and sodium could be obtained from the soil regardless of the base used in leaching, provided equilibrium was reached. "This tends to prove that there is a definite formation in the soil that holds the basic elements, and that the soil has a definite capacity to hold bases."

Brief experiments showed that much larger amounts of colloidal material remain in suspension in water when this material is saturated with sodium than with any other base.

Tillage investigations (*Kansas Sta. Bien. Rpt. 1927–28, p. 25*).—Various methods of preparing the seed bed, including differences in the depth and date of plowing, were compared in the production of wheat crops, soil moisture, and soil nitrate determinations having been made at varying intervals since 1910. The results are considered to show "that in eastern Kansas the time of preparation is the most important factor in determining the yield of the wheat crop. Early plowing . . . has resulted in a gain in yield of 8 bu. per acre as compared with late plowing. The reason has been shown to be the relation between time of tillage and the development of nitrates in the soil, more nitrates being available when the land is plowed early. For the same

seed-bed treatment the yields average 5 bu. per acre greater for wheat grown in rotation than for wheat grown continuously."

[Soil nitrate studies] (*Colorado Sta. Rpt. 1928, pp. 11, 12, 18, 19*).—Rotations on a series of plats for the study of the relation of nitrate behavior to the nature and quantity of organic matter are being used in the investigation by A. Kezer of this problem. As sources of organic matter straw, cornstalks, alfalfa, dried blood, etc., were applied in quantities such that each provided the same quantity of nitrogen.

"Where we add the nitrogen with a carrier having a low percentage there is a decrease of nitrates, that is, plowing under materials rich in nitrogen increases the nitrates after a time, while plowing under materials low in nitrates such as straw or cornstalks temporarily reduces nitrates. The theory is that in the decay of the low nitrogen material more nitrogen is required for the metabolism of the decay organisms than is present in the carrier. Under these conditions the organisms concerned in the decay take their necessary nitrogen supply from the soil, and nitrates are reduced. The action is temporary and apparently does not hold over into succeeding years. This effect seems to be associated also with the use of green manures. A low-nitrogen green manure will help keep down the nitrates for a season."

In a study reported by W. G. Sackett and J. C. Ward on the control of the tendency toward excessive nitrate accumulation in the Arkansas Valley soils, it has been "shown quite conclusively that excessive soil nitrates can be and are depressed by the use of green manures and some crop residues," suggesting their use when soil nitrates threaten to become excessive.

Fungi hold nitrogen in the soil (*Wisconsin Sta. Bul. 405 (1929), pp. 28, 29*).—Soil fungi have been found by A. F. Heck, E. B. Fred, and A. R. Whitson to tie up nitrogen in the production of mycelial tissue when the growth is stimulated by the incorporation of straw or other carbonaceous material into the soil, the conclusion being stated that "soil fungi are thus largely responsible for the rapid depression of available or mineral nitrogen and the lower crop yields . . . when the energy supply of the soil is increased." This effect would appear not to be of long duration, however, since "most fungus tissues decompose readily in moist soils when the supply of energy material has been used up. Forty to 60 per cent of their carbon is liberated as carbon dioxide in 26 days. On decomposition the nitrogen which they contain is liberated as available nitrate to the extent of 30 to 42 per cent of the original amount. The balance is either not liberated or is again combined into new fungus or bacterial substance. The nitrogen in fungus tissue in the soil is as readily, or even more rapidly, nitrified as that of other organic materials.

"The nitrogen compounds in fungus tissue are for the most part very simple. From 40 to 70 per cent of such nitrogen is soluble in water. The nitrogen content of the fungi varies from 2 to 7 per cent, with most of them over 4 per cent, on a dry basis. The energy-nitrogen ratio of the soil is the determining factor, both in the quantity of growth produced and in the amount of nitrogen it contains. When the carbon-nitrogen ratio falls below 12 to 1 the amount of fungus growth is decreased, thus permitting the liberation of more nitrate."

The relation of the absolute reaction of the soil solution to the quantity of nitrogen fixed by Azotobacter (*Kansas Sta. Bien. Rpt. 1927–28, pp. 28, 29*).—Cylinder experiments in which the soils were cropped to oats in 1927 and 1928 are reported.

Azotobacter disappeared from the unlimed soils regardless of the food supply. Sugar-treated cylinders and cylinders limed without other treatment showed none of the organism in 1924, 1925, 1927, or 1928. Inoculated cylinders retained the organism through the first two years reported on, but showed none in the

two latter years. Limed and inoculated soil cylinders showed the presence of the organism throughout the four years reported, as did also the cylinders which had had sugar as well as lime and inoculation. No treatment resulted in the complete absence of the organism in each of the four years, and treatment with straw only had the same result, but the soil treated with lime and with straw and also inoculated, and the soil given lime and inoculum and held fallow showed the presence of Azotobacter in each of the four years represented in the table in which the work is here summarized. Various observations on the nutrient requirements of two species of Azotobacter are reported.

The residual effect of alfalfa on the soil (*Kansas Sta. Bien. Rpt. 1927–28, pp. 24, 25*).—A tabular statement of the average yields, the protein content, the test weight, and the nitrate content of the soil at seeding is given for wheat following alfalfa as compared with wheat grown continuously. "These data show a distinct advantage in favor of the wheat following alfalfa, the average differences being 5.1 bu., 2.4 per cent in protein, 1.3 lbs. in test weight, and 168 lbs. in nitrates at seeding time." It is noted, however, that "it is not intended to recommend the growing of wheat immediately after alfalfa; other crops can usually be grown to better advantage." Previous work on this subject has been noted (E. S. R., 56, p. 811).

The effect of potassium deficiency on metabolism in plants (*New Hampshire Sta. Bul. 238 (1929), pp. 26, 27*).—Tomatoes and radishes were grown by T. G. Phillips and T. O. Smith in 3 sand cultures. A carbohydrate discovered in radishes and shown not to be sucrose, though it was found easily hydrolyzable by acids, was observed in abundance in the radishes grown in the complete nutrient solution. The radishes grown in a second culture solution with about one-tenth as much potassium contained very much less of the carbohydrate, however, and the third group, grown in a culture solution containing no added potassium, contained practically none of this substance. Similar but less marked differences appeared in the analyses of the tomato plants.

Soil and crop experimental fields (*Kansas Sta. Bien. Rpt. 1927–28, pp 30, 31*).—Rotation and fertilizer tests in southeastern Kansas, mostly of the usual nature, are reported in progress, and some current results are tabulated. It is indicated that "land which is not adapted to the production of alfalfa can often be made to produce this crop in a very satisfactory manner by means of proper soil treatments." A yield of 3.5 tons per acre followed the use of lime, manure, and rock phosphate.

Soil fertility investigations (*Kansas Sta. Bien. Rpt. 1927–28, pp. 22–24*).—The general progress of rotation and fertilizer tests of the usual type is reported, together with a study of subsoil moisture variations as affected by continuous alfalfa and by a rotation. Moisture determinations were made to a depth of 10 ft. Thus far the indication of these experiments has been that there is not much change in the subsoil moisture below the fifth foot during average years. The moisture was found to have been used soon after falling, having been taken out by the crop before it could penetrate very deeply. Accumulation of subsoil moisture was very slow on land regularly producing other crops one, five, and nine years after alfalfa had been plowed up.

Laboratory studies on alfalfa demonstration field soils indicated a very close inverse correlation between soluble calcium and returns from the use of lime. When as much as 700 lbs. to the acre, approximately, of calcium soluble in carbonated water was found by the method used, "only slight to medium returns . . . [were] obtained from liming. Where the amount is decidedly less than 700 lbs., good results can usually be expected."

Flood lands helped by tests (*New Hampshire Sta. Bul. 238 (1929), p. 4, fig. 1*).—A study of the characteristics of the flood silt soils deposited to a

depth ranging from 0.25 to 20 in. in the Connecticut River Valley in November, 1927, was made by F. S. Prince in the greenhouse during the winter, with the result that although the flood silt was found too low in organic matter and available nitrogen for maximum yields, the actual limiting factor consisted in potassium and phosphorus deficiencies. The plats of the flood silt manured at 20 tons to the acre gave good crops of alfalfa, sweetclover, and timothy, as did also plats treated with 800 lbs. of 0–12–6 fertilizer to the acre, but 200 lbs. to the acre of sodium nitrate alone gave poor yields.

The reaction of the new soils was found suitable without liming for alfalfa and other legumes, pH values of from 6.8 to 8.32 having been observed by T. G. Phillips. In comparison with this range in the flood silt, it is noted that the general range of pH value in New Hampshire soils is from 5.0 to 6.0.

Plant nutrition investigations (*Kansas Sta. Bien. Rpt. 1927–28, pp. 25–27*).—Five laboratory studies are described.

1. [*Lime and phosphate requirements of Cherokee silt loam*].—Superphosphate with lime considerably increased the growth of alfalfa. Light applications of lime, not more than the equivalent of 2,000 lbs. an acre of hydrated lime, together with 300 lbs. an acre of superphosphate, produced growth as good as that resulting from heavier liming with the same phosphate rate. Determinations of nitrogen, phosphorus, calcium, and potassium in the alfalfa top growth showed that while the liming increased the calcium content of the tops the phosphate did not increase the phosphorus content. Superphosphate without lime slightly decreased the acidity of the soil.

2. *The fertilizer requirements of Cherokee silt loam*.—The triangular system was used in testing the effects of combinations of sodium nitrate, superphosphate, and potassium sulfate, with or without calcium carbonate applications. Winter wheat was followed by alfalfa in these tests, the fertilizers having been applied to the wheat only. Liming did not increase the wheat yield, the average yield of the triangles not limed in fact exceeding that from the limed triangles. The largest grain yields were obtained from the soil treated with the most frequent applications of nitrogen. The phosphate greatly increased the dry weight of the alfalfa first cuttings in the triangle receiving no lime, also in the triangle limed at the rate of 1,200 lbs. an acre. Heavier liming rates combined with fertilizer treatment did not increase the yields.

3. *The comparative effect of lime and superphosphate on 10 different soil types from southeastern Kansas*.—In pot experiments in the greenhouse, wheat having been followed by alfalfa without further fertilizer treatment, superphosphate alone produced better growth than did lime alone in each of the 10 soils, but the best results were obtained from superphosphate with lime. Phosphates appeared to increase alfalfa root nodulation.

4. *The effect of the reaction of the nutrient solution on the growth of alfalfa in sand cultures*.—The H-ion concentration of a complete nutrient solution was varied by varying the proportions of potassium dihydrogen phosphate and dipotassium hydrogen phosphate. The alfalfa grew as well in the solution kept at pH 4.5 as in those maintained at pH 6 and pH 7. This experiment is considered to indicate that acidity in itself is not injurious to alfalfa when available nutrients, especially calcium, are present.

5. *The correlation of base exchange with crop performance and fertilizer practice*.—Replaceable bases were determined by leaching with 0.05 N hydrochloric acid in the cases of 11 southeastern Kansas soil types. "Although it should be noted that data are altogether too meager to admit of any but tentative conclusions, a relationship appears to exist between the yield of alfalfa and the percentage of calcium in the exchangeable bases and between the yield

of alfalfa and the amounts of exchangeable calcium and magnesium. The response of soils to liming is closely associated with the amount of hydrogen absorbed. The correlation between liming response and the pH value of the soil is not consistent. There seems to be a positive correlation between the yield of corn and the content of exchangeable potassium in the soil.

"Soils with a high content of aluminum that is leachable with 0.05 N hydrochloric acid produced in general the lowest yields of corn and alfalfa. The largest yields of alfalfa were secured on those soils that contain a comparatively large amount of soluble silica."

[**Fertilizer requirement tests**] (*Wisconsin Sta. Bul. 405 (1929), pp. 108, 109*).—On peat soils at Coddington Substation and for potatoes in tests made in Barron County (by F. L. Musbach), potassium was the principal need, 300 lbs. of potassium chloride to the acre during each 4-year rotation having proved advisable on the Coddington peat fields. Various formulas and rates are mentioned in the summary of the Barron County potato tests, together with the yield increases and profits. "The results of this test, and of others carried on in the past three years, indicate that potato growers will secure better returns from the use of high potash fertilizers, such as 3–10–10 and 3–12–12, than from the materials they have used most generally in the past, such as 5–8–7 and 4–8–6."

Fertilizer ratio experiments, R. P. Bledsoe and J. J. Skinner (*Georgia Sta. Bul. 151 (1929), pp. 31, figs. 16*).—With the cooperation of the U. S. D. A. Bureau of Chemistry and Soils the station made a study of the triangle system of fertilizer ratios on a rotation of cotton, corn, and wheat followed by cowpeas, grown on Cecil sandy loam.

Of cotton the highest yields and largest profits were obtained by the use of fertilizer of the 6–6–3 ratio, the phosphate response in this case being considered too low for the soil type used. "Secondary centers of high yield developed nearly every year on the ammonia-phosphate line of the triangle," these secondary centers tending to shift from year to year.

Corn responded to the application neither of phosphate nor of potassium salts. Ammonia nitrogen increased the yields of corn, but at small profit. The most profitable rate of application of ammonia was found at 30 lbs. to the acre. "The number of pounds of fodder necessary to produce a pound of grain decreased with each increase of ammonia fertilizer applied."

Phosphates greatly increased the yields and prevented the winterkilling of vetch, according to the results of one year's work with this crop. Corn following vetch turned under as green manure "gave large yields where a large crop had been turned under. It is pointed out that the way to grow cheap corn is to plant winter legumes well supplied with phosphates and turn them under for green manure before planting the corn crop."

Wheat showed marked response to the use of ammonia nitrogen, 27 lbs. having proved profitable in these experiments. It was considered that more could have been used advantageously, "if properly balanced with phosphates." Phosphates had a favorable effect on wheat during the last three years of the test, but, although the quantity needed was not determined, it was believed that the requirement was probably small. Cowpeas appeared greatly increased in yield by phosphate treatment.

Practical applications of the results obtained on Piedmont soils are discussed.

[**Effect of barnyard manure on soil nitrogen**] (*Wisconsin Sta. Bul. 405 (1929), pp. 109, 110, fig. 1*).—No less than 89 per cent of the nitrogen in the solid part of barnyard manure was unrecovered when oats, buckwheat, and corn were grown in succession in the greenhouse on soil treated with the solid

part of horse and cow manure, according to tests made by A. F. Heck, A. R. Whitson, and F. L. Musbach. On the other hand over 88 per cent of the nitrogen in the liquid part of the manure was recovered by the three crops during the same period. When straw was used as it would be for bedding, the nitrogen recovered by the crops was reduced approximately 75 per cent, thus indicating that the presence of straw associated with the manure in the soil helps to "lock up" available nitrogen. "The practical applications from these investigations would consist in the emphasis of the value of the liquid portion of manure, and explains the necessity of immediately plowing under manure after it is spread on the field and before drying can occur."

Nitrate of soda experiments, 1928, W. B. ROGERS (*South Carolina Sta. Circ. 36* (*1929*), *pp. 12, fig. 1*).—This is a report of a study of the effect of time and rate of application on the results obtained in the treatment of cotton, corn, and oats with sodium nitrate.

With 100-lb. increments in the rate of application of sodium nitrate, the increased yields of seed cotton were 177, 157, 183, and 63 lbs. an acre, respectively. Applied at the total rate of 200 lbs. an acre sodium nitrate produced the highest cotton yields when one-fourth of the total was applied at planting and the remaining three-fourths at chopping.

The first 100 lbs. to the acre of sodium nitrate increased the corn yield by an average of 6.2 bu. an acre, each additional 100-lb. increment of the fertilizer adding approximately 3 bu. an acre to the yield. The greatest increase in corn yield obtained from 200-lb. applications of sodium nitrate resulted from applying the fertilizer when the corn was knee-high.

The first 100-lb. application of the nitrate increased the yield of oats by 16.3 bu. an acre, two additional increments of 100 lbs. each of the salt giving respective further increases in yield of 13.9 and 12.9 bu. an acre. Sodium nitrate at the rate of 200 lbs. to the acre was indicated as better applied for oats on February 15 or March 1 than on February 1 or March 15.

[**Calcium as a limiting factor in alfalfa culture**] (*Wisconsin Sta. Bul. 405* (*1929*), *pp. 105, 106*).—Soil acidity per se was found by A. R. Whitson, H. D. Chapman, and H. H. Hull not essentially detrimental provided sufficient available calcium was supplied. "Many acid soils produce good crops of alfalfa, and it was found that a number of such highly acid soils that produced good alfalfa showed an average of 565 lbs. of available calcium per acre, based on analysis with N/25 carbon dioxide solution, while soils of the same degree of acidity but producing poor alfalfa averaged but 346 lbs. per acre of available calcium. Two tons of ground limestone will supply all the calcium needed per acre on practically all calcium-deficient soils, even though this does not completely correct the acidity.

"Available phosphorus is frequently as important a limiting factor in alfalfa culture as calcium. The soils above mentioned, having a high degree of acidity and yet producing good alfalfa, contained an average of 27 lbs. per acre of phosphorus soluble in N/5 nitric acid, while those producing a poor crop of alfalfa contained an average of 15 lbs. of that element. On six fields having only a slight degree of acidity and producing poor crops of alfalfa the average phosphorus content was 11 lbs. per acre, while on 37 fields of the same average acidity but showing better crop growth the soluble phosphorus amounted to 55 lbs. per acre."

Results showing an indication similar with respect to the relative importance of calcium supply and acidity were obtained at the Spooner and Ashland Substations by F. L. Musbach. At the first-named substation 2 tons of lime to the acre gave as good results as applications of the full indicated lime re-

quirement of from 3 to 4 tons to the acre. At the Ashland Substation on Superior red clay "lime is absolutely necessary, and when applied at the rate of 2 tons of limestone per acre, is effective in securing excellent stands and yields of both clover and alfalfa, even though this amount of limestone does not completely neutralize the soil acidity. The original test on this plat showed a reaction of pH 5.33, and two years later after the first crop of alfalfa was cut the test showed pH 5.65, while to be completely neutralized the reading would be pH 7.07."

Barley yielded in 1928, 37.1 bu. per acre when receiving 2 tons of ground limestone per acre, as compared with 25.9 bu. on an unlimed plat.

Analyses of commercial fertilizers, H. E. Curtis, H. R. Allen, and L. Gault (*Kentucky Sta. Bul. 282 (1927), pp. 255–343*).—The usual analyses are reported and discussed.

Inspection of commercial fertilizers for 1928, T. G. Phillips, T. O. Smith, and F. S. Schlenker (*New Hampshire Sta. Bul. [237] (1929), pp. 12*).—This report consists mainly of analyses of 128 brands. On the basis of the total number of guaranties 19.6 per cent of deficiencies were found, as compared with 24.5 per cent the previous year.

AGRICULTURAL BOTANY

The swelling of biocolloids.—[I], Ultraviolet rays and swelling of agar-agar, J. Caláber (*Protoplasma, 3 (1928), pp. 17–42, figs. 8*).—Ultra-violet ray illumination of dry agar-agar influenced considerably the subsequent swelling in distilled water.

Permeability studies on gelatinous membranes [trans. title], R. Collander (*Protoplasma, 3 (1928), pp. 213–222*).—Results are tabulated and discussed of studies, admittedly preliminary, on permeability in gelatin membranes.

Viscosity in protoplasm [trans. title], H. Timmel (*Protoplasma, 3 (1928), pp. 197–212, fig. 1*).—An account in some detail is given of the behavior of contents of cells centrifuged at high speeds and of the influence in this connection of certain electrolytes used.

Potentiometric determinations in the protoplasm and cell-sap of Nitella, C. V. Taylor and D. M. Whitaker (*Protoplasma, 3 (1928), pp. 1–6*).—A method is described for the construction and use of a nonpolarizable microelectrode protected within a quartz electrode chamber so that the electrode may be saturated with hydrogen or with any other gas or any liquid. Using this apparatus as a hydrogen electrode, the authors measured potentials in the protoplasm and in the cell sap of Nitella. It was found that these two media showed very different behavior toward the hydrogen electrode. Protoplasm gave at once a potential of from +0.093 to +0.030 volts with respect to hydrogen zero. These values, which supposedly could not represent the concentration of hydrogen ions within the protoplasm, were regarded as indicating rather its oxidation-reduction potential. Potentiometric readings for the cell sap gave pH values of from 5.47 to 6.16, the latter value supposedly being the more reliable.

Studies on the permeability of living cells.—VIII, The effect of chlorides upon the penetration of dahlia into Nitella, M. M. Brooks (*Protoplasma, 2 (1927), No. 3, pp. 420–427, figs. 3*).—When the penetration of the dye, dahlia, into the sap of Nitella was determined in the presence of NaCl, KCl, $MgCl_2$, and $CaCl_2$ at various concentrations, it was found that penetration of the dye was hindered most by $MgCl_2$ and least by NaCl. The latter of these two salts antagonizes the action of $CaCl_2$ in certain proportions to a small degree without, however, preventing the dye from penetrating at a normal rate.

Penetration of hydrogen cyanide into living cells, F. J. BRINLEY (*Protoplasma, 2 (1927), No. 3, pp. 385–391, figs. 3*).—In aqueous solutions, hydrogen cyanide behaves as a very weak acid, dissociating but slightly. It thus, like carbon dioxide and hydrogen sulfide, enters living cells largely in molecular form and not in the form of ions. The recovery rate of streaming of protoplasm in Elodea cells after its stoppage by immersion in a dilute solution of HCN shows a linear relation. The toxicity of hydrogen cyanide to root hairs of Limnobium gives rise to a uniform curve, and this poison seems to increase the permeability of the cell membrane.

Stomatal movement: Its regulation and regulatory rôle.—A review, G. W. SCARTH (*Protoplasma, 2 (1927), No. 3, pp. 498–511*).—This synthetic review is in two parts, relating, respectively, to the physico-chemical mechanism of stomatal movement and the regulatory rôle of stomatal movement, from a correlation of which parts it is concluded that the stomatal mechanism is self-regulatory. "If, as above, we define the stomata as functioning when they are open and quiescent when they are closed, their principal function is to regulate that very factor which is presumed to regulate them, viz. the concentration of CO_2 in the leaf or, respectively, in the guard cells."

Drought resistance of crop plants (*Kansas Sta. Bien. Rpt. 1927–28, pp. 32–34*).—Two years' work has shown no correlation between the water requirement of the plants and the prevalence of blossom-end rot of tomato, nor did there appear to be any correlation between the number of fruits per plant and the severity of blossom-end rot. In general, it appeared that the varieties with smaller fruit were more resistant to the disease.

It has frequently been claimed that spraying with Bordeaux mixture increases the transpiration rate of tomato plants, but two years' investigations indicated that the average transpiration rate of the plants after spraying was 0.994 times that which prevailed before spraying. It is believed that under Kansas conditions the application of Bordeaux mixture as a spray need not be considered as a factor in relation to the loss of water from plants in the field.

Temperature relations of crop plants (*Kansas Sta. Bien. Rpt. 1927–28, pp. 34–36*).—Some of the results are given of studies on the relation between the resistance to low temperatures and winterkilling of annual plants, the relation of winterkilling to hardening off, and the effect of chilling at temperatures somewhat above freezing on summer plants (E. S. R., 60, p. 321).

Artificial freezing was found to be a promising method of determining the winter hardiness of unknown strains of plants. The absolute as well as the relative ability to withstand low temperatures was found to depend very largely on the temperature to which the plants were subjected before freezing, and in some varieties a longer time was required to acquire hardiness than in other ones.

Studies in 1926–27 of 10 varieties of wheat showed that they fell into three distinct groups—relatively hardy, fairly hardy when hardened before freezing, and nonhardy. Later studies confirmed these conclusions and also placed winter rye in the class with Kanred and Kharkof wheats as to hardiness. Winter oats proved less hardy than winter barley and winter barley was less hardy than the most susceptible varieties of wheat when frozen in an unhardened condition.

Low-temperature injury to stored sugar cane, G. B. SARTORIS (*Jour. Agr. Research [U. S.], 38 (1929), No. 4, pp. 195–203*).—The results are given of a study of the effect of low-temperature storage on the germination of sugarcane. It was found that the best temperature for the storage of sugarcane is from 8 to

10° C., and the cane should be packed in some material that will maintain its moisture content.

The cold storage of sugarcane seed as a regular plantation practice is not considered practicable. At a continuous temperature of 3° the seed cane was found to be injured to such an extent that it would not germinate. Most of the fungi that caused damage to seed cane were found to grow well at 12° and some of them at 7°. At a temperature as low as 6° there was development of the roots and buds of the sugarcane. The freezing point of the juice of sugarcane is said to be about −1°. Seed cuttings of Louisiana Purple did not germinate after exposure to a temperature of from −2 to −5° for more than 80 minutes. On the other hand, the cuttings of P. O. J. 213 germinated after exposure to a temperature of −1.5° for 105 minutes.

GENETICS

Genetic equilibrium and selection, W. B. KEMP (*Genetics, 14 (1929), No. 1, pp. 85–127, figs. 2*).—The author discusses genetic equilibrium under self-fertilization and random fertilization, from which formulas have been derived to indicate when equilibrium will occur in cases where the homozygous-dominant, heterozygous, and homozygous-recessive individuals have different reproductive capacities and are present in different proportions in the population.

From these formulas it is concluded that before equilibrium can be established for a segregating detrimental factor in an inbred population the heterozygote must be more than twice as reproductive as either homozygote, and if, under conditions of inbreeding, hybrid vigor is sufficient to maintain finite equilibrium the reproductive capacity of the population as a whole continues to decrease from F_1 to equilibrium. Detrimental recessives are eliminated in the same manner under random breeding as under self-fertilization, but to keep productivity unequal allelomorphs in a random population the heterozygote must be more reproductive than either homozygote. Genetic equilibrium is established in a random population at the reproductive maximum.

Certain practical applications of the theoretical findings are discussed, from which it is concluded that "barring mutation in random-bred forms, man is enabled to effect and maintain germinal improvement by selection to the extent that he utilizes the margin of variation between reproductive ability and productive ability within the environment in which the form is grown."

Heritable characters in maize.—XXXII, Sorghum tassel, H. K. HAYES and H. E. BREWBAKER (*Jour. Heredity, 19 (1928), No. 12, pp. 560–567, figs. 4*).—The thirty-second of this series (E. S. R., 59, p. 821) describes a variation called sorghum tassel (*Sg sg*) which appeared in a selfed line of Rustler White Dent corn at the Minnesota Experiment Station. The tassel, which contains both male and female florets, resembles sorghum, while the ear has a characteristic irregularity of rows. Sorghum tassel plants grow somewhat less vigorously than normal plants. Definite indications of linkage were not obtained in a study in F_2 of the linkage relation for sorghum tassel and 18 other characters in known linkage groups. In a cross between sorghum tassel and tunicate, ears of "cauliflower" type were obtained in F_2. The character seems to be a simple recessive.

Lodging in selfed lines of maize and in F_1 crosses, H. K. HAYES and C. K. MCCLELLAND (*Jour. Amer. Soc. Agron., 20 (1928), No. 12, pp. 1314–1317*).—Selfed lines of Northwestern Dent corn, Minnesota No. 13, and Rustler, and F_1 crosses between lines in the same variety were subjected to a severe wind and rainstorm at about silking time at the Minnesota Experiment Station. A lodging

index was determined by multiplying the number of stalks of each group by the angle of inclination of that group and dividing the sum by the number of stalks in the row.

Where the parents differed widely in ability to withstand lodging, the F_1 was, in general, of intermediate habit. When both parents had low lodging indexes the F_1 cross was also low, and when both parents had high lodging indexes the F_1 crosses usually lodged severely. The correlation coefficients for the comparison of lodging of the average of the parents and their F_1 crosses in the three varieties were $+0.72\pm0.07$, $+0.77\pm0.05$, and $+0.65\pm0.07$, respectively, indicating that ability to withstand lodging depended to a considerable extent on inherited differences.

Studies in animal reproduction and inheritance (*Kansas Sta. Bien. Rpt. 1927–28, pp. 106, 107*).—In experiments with guinea pigs it was determined that black tipping found in red-colored individuals and in *Cr* whites was dominant.

Although the breeding data for the period 1913–1921 indicated that female guinea pigs 15 months of age at parturition produced a significantly higher percentage of males than dams at other ages, the 1922–1925 data showed that females of this age produced equal proportions of the two sexes. Efforts to select high- and low-producing male strains were unsuccessful.

In the experiments with rabbits, a grain mixture consisting mainly of rolled oats but also containing wheat germ, skim milk powder, cod-liver oil, and table salt plus alfalfa meal was found to increase reproduction and favor lactation.

No offspring showing defective eyes were produced from matings of parents whose eyes were needled, although a defective-eyed male was produced from normal untreated parents.

Albino cattle furnish interesting problem in inheritance (*Wisconsin Sta. Bul. 405 (1929), pp. 65, 66, fig. 1*).—Pink-eyed white cattle are reported as occurring in a grade Holstein-Friesian herd which tend to develop some pigment in the irises with advancing age, though the pupils remain pink. Available breeding reports indicate that the condition is not inherited in a simple manner.

Studies in the inheritance of the grouse locust (*Kansas Sta. Bien. Rpt. 1927–28, pp. 107, 108*).—In continuing these studies (E. S. R., 60, p. 218) a new characteristic described as intensive black was discovered in *Apotettix eurycephalus* and its position on the chromosome located.

The passage of ultra-violet light through Cel-O-Glass cages was found to be more beneficial than the light passing through glass cages for the breeding of the grouse locust.

Unequal sex-ratios in hybrid pigeons explained (*Wisconsin Sta. Bul. 405 (1929), pp. 66, 67*).—In matings of common domesticated pigeons with Ring Doves, a species cross, the 200 hybrids raised to the age where sex could be determined were all males except three, about whose sex there was some question. Candling the eggs incubated indicated that there was a very high death rate of embryos three or four days after development started.

Chromosome studies of the body cells of hybrid embryos at early stages showed that both sexes were present in approximately equal numbers, while the cells of the adult birds showed the chromosome picture for the male. These results thus indicate that the lack of females among the hybrids is due to early differential mortality and not to sex reversal.

[**Genetic experiments with poultry at the Kansas Station** (*Kansas Sta. Bien. Rpt. 1927–28, pp. 98–101*).—The following results are reported in continuation of studies previously noted (E. S. R., 56, p. 817).

Inheritance of down color and of down on toes in poultry.—Breeding experiments with Single Comb Rhode Island Reds indicated that variations in the down color of chicks were heritable, but the color grade was not related to the sex. Light and dark strains, which showed practically no overlapping, were produced through selection over a 4-year period. F_1s produced by crossing these strains showed an intermediate distribution in the down color, which appears to be explained on the basis of one pair of factors in which dominance is lacking.

Strains of Single Comb White Leghorns were produced through selection in which the feet and shanks were free from feathering, while another strain showed considerable down on the toes. The latter strain did not breed true, about one-third of the offspring failing to show down at hatching. By crossing strains showing the contrasting characteristics, the absence of down was found to be almost completely dominant without evidence of sex linkage.

Inheritance of certain characters in Single Comb White Leghorns and Jersey Black Giants.—In a study of the inheritance of ear lobe color, it was found in crossing breeds showing red with white that those showing white ear lobes produced offspring which were intermediate in color, although some had all-red and others all-white ear lobes. The ear lobe color is dependent upon at least three genetic factors, two of which are autosomal while the third is sex linked. There was no genetic or physiological linkage between ear lobe color and shell color, although such are associated in many breeds.

From a study of the linkage relations between the sex-linked characters, it was suggested that the genes for gold-silver and rate of feathering are in one end of the chromosome separated by 15 units, while the genes for barring and shank color are in the opposite end.

The first-generation hybrids between the Single Comb White Leghorns and Jersey Black Giants showed exceptional vigor. F_1 hybrids were superior to either of the two breeds in egg production, chick mortality, percentage of hatchability, and rate of growth, and in most instances the differences were statistically significant.

The inheritance of egg production in Single Comb Rhode Island Reds.—Efforts to select early- and late-maturing strains were somewhat successful in the second year of this test.

FIELD CROPS

[**Field crops work in Georgia, 1928**] (*Georgia Sta. Rpt. 1928, pp. 11–16, 17, fig. 1*).—Seed cotton stored for from 30 to 180 days did not vary much in percentage of lint, based on dry weight. With bolls blooming up to July 20 lint percentage increased quite markedly, slightly from July 20 to August 4, and declined sharply August 7. The first flowers gave the longest lint, although there was not much decrease until August 1. Plants stripped of all but three squares to simulate boll weevil conditions produced longer fiber than normal plants. Lint from the tip of the seed was shorter than lint from the middle and base, which did not differ much. The lint percentage was slightly higher in unthinned cotton than in 20-in. spacing, whereas the size of bolls increased with the width of spacing.

Excessive quantities of nitrogen applied as sodium nitrate slightly increased the percentage of immature hairs, while a normal application slightly decreased the number. Applied in quantities in excess of the needs of the plants nitrogen slightly decreased, phosphorus slightly increased, and potassium almost doubled the number of immature hairs. Cotton plants growing in nutrient solutions containing nearly equivalent quantities of ammonia

nitrogen and nitrate nitrogen absorbed more nitrate nitrogen than ammonia nitrogen. Plants three weeks old grown in nutrient solution containing ammonium sulfate as the sole source of nitrogen changed the pH concentration from 5.8 to 4 in 48 hours. In a nutrient solution containing nitrates as the nitrogen source and at an initial pH 5.6, plants developed severe chlorosis when three weeks old.

Breeding work has resulted in productive selections of Purplestraw wheat, Red Rustproof oats, and of soybeans from Laredo×Biloxi. Outstanding introductions were Kobe lespedeza, and Manila, centipede, and Kweek grasses.

[**Agronomic investigations in Kansas, 1926–1928**] (*Kansas Sta. Bien. Rpt. 1927–28, pp. 36–50, 128–131, 134–136, 137–140, fig. 1*).—Further experiments with field crops (E. S. R., 56, p. 822) reported on from the station and substations embraced variety tests with wheat, corn, pop corn, oats, alfalfa, grain sorghum, soybeans, sweetclover, lawn grasses, and miscellaneous legumes; breeding work with wheat, corn, oats, barley, and sorghum; cultural (including planting) trials with wheat, oats, corn, soybeans, alfalfa, and sorghum; fertilizer trials with pasture and lawn grasses; cutting tests with alfalfa and soybeans; a genetic study of aberrant and false wild types in Kanota oats; seed treatment with corn; pasture studies (E. S. R., 60, p. 358); and weed-control investigations.

Early seeding of wheat, i. e., before October 1, decidedly surpassed late seeding as to yield, again demonstrating the danger of delay, unless necessary because of Hessian fly, inclement weather, etc. Tests covering about twelve seasons showed that the optimum seeding time for control of the fly did not necessarily coincide with the best dates for those seasons and localities with no Hessian fly. When no Hessian fly is present, seeding should begin near Manhattan 7 or 10 days earlier than the fly-safe date.

Alfalfa varieties maintaining best stands included Ladak, a Provence strain, Turkestan, and Kansas Common. Grimm and Cossack made poor stands, alfalfa from Spain and South Africa was especially unadapted, and Argentine alfalfa did not thrive longer than two or three years. A marked difference in susceptibility to bacterial wilt was suggested. Evidence that the loss in stand on plats cut often has been due to bacterial wilt suggested a relation between frequency of cutting and the onset of the disease. Plats cut in full bloom throughout the season produced the most grass-free hay, whereas stands grew poorer on plats cut continually in the bud stage.

When prairie grass pasture was clipped at different times and frequencies to simulate various methods and intensities of grazing, it was found that the roots from plats clipped every 10 days contained only about one-half as much starch as roots from unclipped grass. Grass protected until August 1 and clipped every 10 days thereafter until the close of the season had more stored food material than that clipped every 20 days, suggesting that prairie grasses begin to store food material early rather than near the close of the season.

In attempts to eradicate undesirable plants from pasture lands, buck brush and sumac were cut off at the ground every two weeks during the growing season. Buck brush contained the least starch in both roots and stems about May 15, while the minimum amount in the stems was found about June 15. The time of least quantity of stored food material agreed with the effectiveness of cutting. Cuttings about May 15 were about 75 per cent effective in buck brush, while about June 15 was about 50 per cent effective with sumac, and the effectiveness decreased in both cases with earlier and later cuttings.

When seeds of eleven species of weeds were buried in a silo in sorgo silage in October and withdrawn in December, January, and February and tested for

germination in March, only field bindweed, morning-glory, and velvet leaf germinated, but the latter two germinated better than the checks left out of the silo under natural conditions. Eradication of bindweed with sodium chlorate has been noted elswhere (E. S. R., 59, p. 137).

Cooperative tests with farmers throughout the State as heretofore included varietal comparisons with corn, kafir, wheat, oats, barley, alfalfa, and soybeans. Superphosphate and manure gave about equal increases in yield when applied on alfalfa in eastern Kansas, the increase amounting to about 1 ton in 1927 and 0.5 ton in all tests made since 1914.

Experiments at Hays (E. S. R., 58, p. 532) indicated September 20 to October 6 and a 4-pk. acre rate as the best for seeding winter wheat. Heavier rates may prove beneficial in dry autumns if severe soil blowing occurs in the spring. Comparisons of different methods of pasturing winter wheat with horses showed that the moderate pasturing of a heavy growth is not injurious and may prove beneficial to the wheat. Where the growth is limited, pasturing generally results in reduced wheat yields. In seasons of drought and slow fall growth, wheat pasture is not dependable as a feed supply for livestock.

Investigations at Garden City on dry land, in cooperation with the U. S. Department of Agriculture, have been noted earlier (E. S. R., 58, p. 129). Alfalfa appeared to make better use of irrigation water supplied in early spring than of equal quantities applied late in the previous fall. Spring irrigation tended to stimulate an earlier and more vigorous growth, resulting in a heavier first crop. Alfalfa required from 36 to 42 in. of water annually for best results. Cutting tests showed that much better hay could be obtained from the first and second crops if early cutting is practicable. Increased yields of both grain and forage came from sorghum grown in rotation with alfalfa, whereas barnyard manure and commercial fertilizers have not materially increased yields of Dwarf Yellow milo, winter wheat, or alfalfa. Sugar beets and irrigated pasture grasses, however, responded to applications of manure.

In experiments at Colby, in similar cooperation, winter wheat on dry land has averaged 7.7 bu. after barley, 8.3 after winter wheat, and 13 bu. after pinto beans. On different seed-bed preparations the higher 11-year averages of winter wheat were 18.9 bu. on summer tilled land and 18.6 bu. after rye for green manure and then summer worked, as compared with from 7 to 11.1 bu. from continuous winter wheat. The optimum seeding rate for winter wheat was from 2 to 4 pk. per acre. The furrow drill appeared to be distinctly superior to the press drill at the 3- and 4-pk. rates of seeding, and possibly better at the 2-pk. rate of seeding. For the very thin rate of 1 pk. per acre, the press drill was evidently better than the furrow drill.

[Crop experiments in New Hampshire] (*New Hampshire Sta. Bul. 238* (*1929*), *pp. 5–7, 27, 28*).—Grass on neglected hay lands in studies by F. S. Prince and T. G. Phillips responded noticeably to 100-lb. applications of sodium nitrate, especially when not receiving manure, and to lime, whereas superphosphate apparently failed to return a significant increase. With alfalfa, potassium (as chloride) alone was the only nutrient giving increases in hay yields for two cuttings worth more than its cost. Other treatments returned increases in either the first or second cutting. Oats in the dairy farm rotation on worn-out hay land responded in yields to liming.

Scattering the fertilizer for potatoes in the row with the seed, in tests by F. W. Taylor, appeared to be a slightly better method than placement above, below, or beside the seed. Potatoes returned increased yields with the higher percentages of potassium in the fertilizer and with the heavier applications of

manure. In a 1-year trial, sulfate nitrogen (ammonium sulfate) did not seem quite so desirable for potatoes as a mixture of sulfate and nitrate (sodium nitrate) nitrogen. Equivalent quantities of ordinary (4-8-4) and of quadruple strength (16-32-16) fertilizer were similar as to resultant yields, and no injurious effect came from the concentrated material.

In attempts to control mustard, R. Bissey found that sodium nitrate was more active when dried slowly, whereas the reverse was true for copper nitrate, copper sulfate, sodium hydroxide, ammonium sulfate, sodium carbonate, and sulfuric acid. The strength of the herbicide necessary to obtain an 80 per cent kill was for copper nitrate 1 per cent, sulfuric acid 1.5, copper sulfate 1.8, ferrous sulfate 10, and ammonium sulfate 36 per cent.

[**Field crops work in Tennessee**], C. A. Mooers, S. A. Robert, and L. R. Neel (*Tennessee Sta. Rpt. 1928, pp. 8-15, 39-44, 45, 46, 51, figs. 16*).—The outstanding results are reported from varietal trials with cotton, corn, red clover, lespedeza, alfalfa, and miscellaneous grasses and clovers; breeding work with cotton, corn, red clover, and lespedeza; cultural (including planting) tests with cotton, corn, soybeans, and sweetpotatoes; fertilizer tests with cotton; and crop rotations.

[**Field crops investigations in Wisconsin, 1927-28**] (*Wisconsin Sta. Bul. 405 (1929), pp. 26-28, 67-70, 89-103, 106, 107, figs. 13*).—Further experiments with field crops (E. S. R., 59, p. 33) are reported on.

Wide differences were found by I. L. Baldwin and E. B. Fred in the stimulation which clover received from symbiosis, although nodules were produced on the roots by all the strains of clover bacteria. Under controlled greenhouse conditions a correlation was apparent between the kind and location of nodules on the roots and the benefit the plant derived from symbiosis. The best strains gave relatively few but larger nodules located near the top of the root system, while the poorer strains resulted in many small nodules scattered over the entire root system. According to O. N. Allen, working with Baldwin and Fred, the better strains of legume bacteria tend to be reduced in effectiveness, while poorer strains have their potency increased when repeatedly passed through host plants. In field tests near Sauk City, Fred and Baldwin found that in strongly acid soil the nodule organism is comparatively short lived and inoculation is necessary, even though the field recently may have produced a good crop of peas. As the result of fresh inoculation old fields strongly acid gave as much as 50 per cent increase in yield, whereas some fields showing little or no acid did not give significant increases, even though peas had not been grown thereon for as long as 10 years.

Promising crops included a sweetclover resembling alfalfa in growth habit; a bush type wax bean (Keeney Refugee Wax×Wells Red Kidney), suitable for harvesting by machinery, with a round, stringless pod relatively free from fiber, uniform in maturity, and escaping bacterial blight and mosaic; hybrids between inbred corn lines outyielding the open-pollinated plants, more uniform in plant and ear characters, and resistant to disease, low temperature, and lodging; a dent-flint corn cross from 7 to 10 days earlier than Wisconsin 25; a high yielding barbless barley, Wisconsin Pedigree 37; Primal, Alcross, No. 19 Alaska, Acme, and Ashford canning peas; and Progress, a spring wheat resistant to stem rust.

Wisconsin corn varieties grown in Nebraska for two or more years did not mature satisfactorily in Wisconsin in comparisons by A. H. Wright and B. D. Leith, and the use of such seed is not generally advised. Using bin driers for the curing of seed corn, Wright found that temperatures as high as 120° F. may be employed safely, regardless of the initial moisture content of the corn. When treated by moving air currents, corn with a large moisture content could with-

stand as high temperatures as comparatively dry corn. In commercial practice the most economical temperature is from 100 to 110°. Corn dried rapidly (60 hours) as compared with slower drying, has not been injured in germination, seedling growth, or maturation. Wright also found that corn can be dried to as low as 5 per cent moisture without damage, but that the more completely seed corn is dried the slower is the germination, and that nothing is gained by drying below 12 per cent moisture.

Sunflowers, in trials by E. J. Delwiche at Ashland, have continued to surpass corn as a silage crop on red clay soils bordering on Lake Superior, averaging for 10 years 11.3 tons per acre as compared with 6.5 tons for corn. Sunflowers also can withstand without injury the light summer and early fall frosts which nearly always killed corn. This also holds true for much of the heavy soil areas of north-central Wisconsin.

All plants of Wisconsin-grown red clover, followed closely by the Tennessee anthracnose-resistant strain in tests by A. L. Stone, maintained fair stands in spite of the severe killing in the winter and spring of 1927 and 1928, whereas few types except those of the hairy American type survived irrespective of the source. Canadian seed, however, was as good as the Wisconsin seed.

Fertile bluegrass pastures grazed heavily, closely, and prematurely were found by L. F. Graber to be severely injured by white grub. The early and continuous heavy clipping of permanent pastures made impossible that maturity permitting the manufacture and storage in the grass roots and rhizomes of adequate organic nutrients. Likewise a lack of fertility and shallow soil lessened root and rhizome development. Under such conditions the amount of subterranean plant growth was so limited that white grubs devoured all of the roots, and the sods could be lifted from the soil like a mat. Samples of sod from heavily grazed pastures consistently showed from 35 to 50 per cent less subterranean growth than sods from properly managed pastures. Bluegrass and redtop grown in the greenhouse for 2 months produced from 7 to 18 times as much root growth when not clipped as when clipped 7 times. Overgrazing permitted the encroachment of such unpalatable weeds as mullein, ragweed, and vervain.

Supplemental pasture crops, such as rye, may solve the problem of overstocked permanent pastures. Winter rye seeded the previous fall in trials by G. B. Mortimer and I. W. Rupel has shown a carrying capacity per acre of two cattle for from three to four weeks. Following the rye with a crop of corn or with Sudan grass utilized the field for the entire season. Sudan grass carried an equivalent to one mature cow per acre for 88 days.

Phosphates were found by A. R. Midgley to move very slowly into the soil of permanent pastures, indicating the inefficiency of phosphate applications made on the surface. Lime as ground limestone moved downward comparatively rapidly. Phosphate treatments needed on bluegrass pastures must enter into the soil at least a few inches deep, and when topography permits, this can be accomplished with a disk harrow or disk fertilizer drill early in the spring before growth has started and while the ground is yet soft. Pasture fertilizer trials under the supervision of Mortimer and G. Richards indicated that pasture yields can be increased as much as 100 per cent when enough lime, nitrogen, prosphorus, and potassium are added. The quickest response came from applications of manure, and the reseeding of 5 lbs. of white clover per acre along with the manure was the most efficient of methods tested, although a complete commercial fertilizer was nearly as good. Possibilities were indicated in the reseeding of permanent pastures which contain adequate lime and phosphates with legumes, such as red clover, alsike clover, white Dutch clover, and Ladino clover, as well as common white clover.

During the winter of 1927–28 at Hancock, even rye suffered from winterkilling, especially the early October plantings. Common alfalfa (Dakota No. 12) winterkilled about twice as much as Grimm, whereas sweetclover came through without injury, even surviving under standing ice and water in midwinter, conditions under which clover and alfalfa completely killed. Potassium and phosphorous fertilizers added by A. R. Albert to alfalfa greatly increased the ability of the crop to withstand winterkilling. The gradual reduction in yield over three years was less striking in treated than in untreated plats. The yields rose with increase in potassium applications, which were profitable up to about 300 lbs. of potash per acre, and these plats showed a minimum of winterkilling as compared with plats treated with other commercial fertilizers or manure. Phosphates were not indicated for alfalfa on such sandy soils as at Hancock, but when supplementing potash, yields were increased, and to a lesser degree with manure.

High-grade alfalfa hay: Methods of producing, baling, and loading for market, E. C. PARKER (*U. S. Dept. Agr., Farmers' Bul. 1539 (1929), pp. [1]+26, figs. 12*).—The value and characteristics of high-grade alfalfa hay are set forth, and the causes of low-grade alfalfa hay are indicated. Cultural, harvesting, curing, storage, baling, and marketing practices essential to the production of the high-grade hay are described briefly.

Tillage practices in relation to corn production, T. A. KIESSELBACH, A. ANDERSON, and W. E. LYNESS (*Nebraska Sta. Bul. 232 (1928), pp. 19*).—Investigations to compare different methods of seed-bed preparation, planting, and cultivation used in growing corn and concerning the effects of intertillage and of cropping upon the moisture and nitrate contents of the soil ranged from 6 to 12 years in duration.

Early spring plowing yielded 12 per cent more grain per acre than late spring plowing and 13 per cent more than fall plowing. With late spring plowing, a previous early spring disking increased the yield 7 per cent. Plowing early in the spring from 4- to 10-in. depths yielded from 31.4 to 36.4 bu. per acre, although plowing deeper than 7 in. seemed impractical.

Among six methods of planting corn in furrows with either the lister or furrow attachment to planter, the extreme variation in yield was only 2 bu. per acre. The best listing practices, either double listing in the spring or single listing preceded by early spring double disking, yielded slightly less than the best surface planting practice on plowed ground. Practically equal yields were had from corn surface planted in hills or in drills, provided the stands were comparable. In corn rows 7 ft. apart, i. e., double distance, the grain yield was reduced 23 per cent when the stand per row remained normal and was reduced 14 per cent with twice the normal number of plants per row such as to provide the normal acre stand.

The planting rate may vary somewhat without affecting very materially the grain yield per acre. Checked corn with hills 3.5 ft. apart and stands of 1, 2, 3, 4, and 5 plants per hill yielded at the respective rates of 36.8, 45.4, 48.7, 46, and 42.9 bu. per acre. An average of 2.5 to 3 plants in hills 3.5 ft. apart or its equivalent in drilled corn appeared most practical for standard varieties in eastern Nebraska. Where 51.4 bu. per acre were obtained from a uniform stand of 3 plants per hill, alternating hills with 2 and 4 plants yielded 52.3 bu., with 1, 2, 3, 4, and 5 plants yielded 51.6 bu., and alternating hills of 1, 3, and 5 plants yielded 50.3 bu., indicating that the irregular distribution of plants averaged equally with the uniform, the same number of plants being grown per acre.

Corn cultivated normally, 0, 1, 2, 3, and 4 times, respectively, yielded 7.1, 21.6, 33.6, 35.9, and 37.2 bu. per acre. Continued late cultivation after corn was laid

by normally reduced the yield 2 bu. Plats merely hoed to prevent weed growth yielded 2.1 bu. less than corn receiving four normal cultivations. With a 6-shovel cultivator shallow cultivations averaged 35.8 bu., medium 37.2, deep 38.1, and close cultivations 36.2 bu. per acre.

Little or no relation was noted between the type of tillage treatment and the reduction of soil moisture during the growing season. In corresponding fallow areas, however, plats merely scraped to control weeds conserved moisture slightly less effectively than plats cultivated normally. There was indication that normal cultivation was conducive to a somewhat increased rate of nitrification as compared with scraping to prevent weed growth.

Fertilizer experiments with cotton, J. T. WILLIAMSON (*Alabama Sta. Bul. 228 (1929), pp. 31*).—Cooperative fertilizer experiments with cotton from 1911 to 1922 (E. S. R., 48, p. 832), showed conclusively that, with the possible exception of the Piedmont Plateau, cotton planted on any of the several soil regions of Alabama should be treated with a complete fertilizer, and that a safe minimum application for cotton per acre is 100 lbs. of sodium nitrate, 200 lbs. of superphosphate, and 25 lbs. of potassium chloride. Based on these results, later tests (1923–1927) were made to determine the value of further increments of each of the nutrient materials.

Best returns usually were obtained when 650 lbs. per acre of a mixture in the above proportions was used. When applied in any other ratio or small quantity smaller profits resulted, and while 975 lbs. of a mixture was often more profitable than 650 lbs., the small margin of profit made did not generally recommend the higher rate. On the Houston soils group in the Black Belt the base application was advised.

The greatest response to the further addition to the base application of a second 100 lbs. of sodium nitrate, a second 200 lbs. of superphosphate, or a second 25 lbs. of potassium chloride was had on the soils of the Highland Rim and the Appalachian Plateau, and the least on the Houston soils group of the Black Belt. The maximum increase due to additional quantities of a particular nutrient over the base application was usually obtained when the carrier was used with additional quantities of the other two nutrients. Additional nitrogen over the basic application made the greatest increases on the soils of the Appalachian Plateau, the Oktibbeha group of the Black Belt, and the Limestone Valleys. Additional phosphorus gave largest returns on the soils of the Highland Rim and the Oktibbeha group, and additional potassium gave largest returns on the Norfolk soils of the Coastal Plain and on the Highland Rim soils. The increase due to fertilizers was not influenced consistently by the fertility of the soil.

Rate and date of sowing oats, H. L. BORST (*Ohio Sta. Bimo. Bul., 14 (1929), No. 2, pp. 44–48*).—Over a range of seeding dates (1923–1928) covering the latter half of March and the month of April decreases in oat yields and in weight per bushel came from successively later planting. An 8-pk. rate of seeding had a slight advantage over six years if net yields are considered, although a 6-pk. rate seemed optimum for nurse crop purposes. With Fulghum oats, the heavier rates did not appear to be superior to the lighter seeding rates in the later plantings.

Methods of winter wheat tillage, A. L. NELSON (*Wyoming Sta. Bul. 161 (1929), pp. 37–52*).—Further experiments (E. S. R., 56, p. 829) in winter wheat production showed that furrow drilled seedings outyielded those made with the common drill. Yields from early and late plowings were similar when furrow drilled, while late plowing was better when seeded with the common drill. While duckfoot (unplowed) fallow produced slightly less than plowed fallow

when furrow drilled, the difference hardly justified plowing. Seedings with the common drill yielded on duckfoot fallow about midway between yields from early and late plowed fallow. In 1928 early tillage with the duckfoot produced larger yields than when such tillage was delayed until late spring or early summer, and straw left on the land did not reduce the yields.

Subsoiling, plowing, listing, and disking have been about equal in winter wheat production on land continuously cropped to winter wheat or when winter wheat is seeded in the stubble of other small grains. Plowed winter wheat stubble plats averaged about the same as unplowed winter wheat stubble plats. Seeding in oat stubble had no advantage over seeding in winter wheat stubble. Seedings of winter wheat in corn rows with the corn row drill produced yields slightly less than spring wheat seeded on disked or duckfooted corn ground. The best seeding rates were about 2 pk. per acre with the furrow drill and on about September 1, with August 15 and September 15 seedings also producing good yields.

Grazing of winter wheat, H. H. Finnell (*[Oklahoma] Panhandle Sta., Panhandle Bul. 4 (1929), pp. 7–10*).—Grazing winter wheat up to April 1 did not affect the numbers of tillers produced by the plant, delay maturity, or reduce yield, whereas wheat grazed until April 26 produced fewer heads per plant than normal and considerably less grain, although time of maturity was similar. Grazings on May 3 and May 9 further decreased yields, and maturity was delayed 5 and 9 days, respectively. While a safe time of pasturing would lie between April 1 and 15, the progress and stage of growth of the plant is deemed the best index. Grazing was not found to affect the number of smutted plants existing in the crop grazed. Differences in the percentage of smut (stinking) found in fields grazed for different periods were due to the subduing of smutted plants more than sound plants. However, it is not deemed advisable to attempt the reduction of stinking smut by late grazing, since only a slight decrease is possible and the loss in yield more than offsets the gain in grade of wheat.

Inheritance of yield and protein content in crosses of Marquis and Kota spring wheats grown in Montana, J. A. Clark and K. S. Quisenberry (*Jour. Agr. Research [U. S.], 38 (1929), No. 4, pp. 205–217*).—The inheritance of yield and crude protein content, the genetic factors involved for awnedness and dwarfness, and the effect of awns and dwarfs on the yield and protein content of the hybrid plants and strains were studied by the U. S. D. A. Bureau of Plant Industry in cooperation with the Montana Experiment Station in crosses between Marquis and Kota wheats in 1926 and 1927. The awnleted Marquis parent had outyielded the awned Kota parent in varietal trials covering the previous five years under favorable conditions at Bozeman and Moccasin but not under unfavorable conditions at Havre. Kota had exceeded Marquis in crude protein content at all three places.

Dwarf plants were recessive to normal, with a two-factor difference apparent, while awnedness was recessive to the awnleted condition, with a single factor difference. Dwarf plants caused a significant difference in acre yield of F_3 rows but none on the basis of yield per plant. The behavior in F_2 and F_3 led to the conclusion that in crosses between Kota and Marquis wheats grown under favorable conditions at Bozeman, awnleted selections average higher than awned selections in yield but lower in protein content.

While yield and protein content were negatively correlated and yields of F_2 plants in 1926 and F_3 strains in 1927 were correlated positively, neither coefficient was of importance. However, the crude protein content of F_2 plants and of F_3 strains was correlated positively and was both significant and important, suggesting that in breeding for high content of protein,

selection of high protein plants in the segregating F_2 generation offers a promising method of attack.

[**Factors influencing the quality of Kansas wheat**] (*Kansas Sta. Bien. Rpt. 1927–28, pp. 51–55*).—Further experiments (E. S. R., 56, p. 830) continued to show that the most notable effect of the cropping system and the fertilizer treatments is on the protein content of wheat, those soil treatments giving a seed bed well supplied with nitrates and producing high protein wheat. Wheat on land plowed 12 in. deep in July usually exceeded in protein content that on land plowed shallower in July, or later. The quality of wheat differed between varieties and also for different seasons for varieties as a group.

When tested by the severe method of mixing dough, Blackhull gave a much smaller loaf volume and poorer texture than Kanred or Turkey, whereas mixed by gentler methods Blackhull produced as good bread as hard winter wheats. This suggested that the range of conditions under which Blackhull may be used satisfactorily by the baker is restricted. Superhard wheat was even less satisfactory than Blackhull.

Wheat grown at the station in 1927 and cut when green, barely ripe, ripe, and dead ripe was threshed and immediately after placed in flat tin gallon cans and heated at 40, 45, 50, and 55° C. for from 1 to 10 days. Subsequent germination, milling, and baking tests showed that wheat cut before fully mature was greatly reduced in germination by high temperatures, while that cut after full maturity could be heated for 10 days at 50° or 5 days at 55° without apparent injury. Test weight rose as the wheat matured, whereas the percentage of flour did not vary regularly with the stage of cutting or amount of heat. Flour from wheat cut the greenest was the highest in ash, and that from the ripest wheat had the least. Heating increased the ash content, except in the flour from the mature wheat, indicating that bin-burnt wheat in the mill mix will raise the percentage of ash. All wheat cut green produced bread poor in volume and texture. However, bread from wheat cut in the second and third stages was distinctly improved in volume and texture by heating at 40°, the best bread being obtained from wheat heated the longest. It was also improved by heating at 45°, especially for 5 days. Temperatures of 50 and 55° were injurious to all samples cut in the second and third stages, whereas the fourth stage was not affected in quality by heat. Heat was prejudicial to color whenever the volume and texture were affected unfavorably.

The best milling results were had when wheat was tempered at 15 per cent of moisture or a little above. Heating the wheat caused a more rapid penetration of water, permitting a shorter tempering period. With heated wheat short tempers gave better results than longer tempers. In many ways a short temper, 6 hours, was better than a long temper of 24 hours. It seemed that 6 hours at room temperature is sufficient for the tempering water to penetrate to all parts of the kernel. Longer tempering at this temperature appeared to harm the protein of the endosperm.

The combination cleaning and treating of seed wheat, F. C. Meier, E. G. Boerner, G. P. Bodnar, C. E. Leighty, and J. E. Coke (*U. S. Dept. Agr. Leaflet 53* (*1929*), *pp. 8, figs. 4*).—The merits of removing weed seeds and treating seed wheat for stinking smut in a combined operation are described briefly, with an account by Coke of the organization and operation of a community grain-cleaning and treating machine.

A physiological study of dormancy in vetch seed, J. P. Jones (*New York Cornell Sta. Mem. 120* (*1928*), *pp. 50, figs. 11*).—The factors involved in and the causes of dormancy (hard seed) in vetch were subjected to investigation. Hard

seed may or may not be present in spring vetch (*Vicia sativa*) and are seldom plentiful enough to compare with the higher percentages usual in winter vetch (*V. villosa*).

Domancy in seed of *V. villosa* was found to be due to failure to absorb water because of impermeability of the seed coat. The germination of hard seed was obtained successfully by any means of rupturing the seed coat. The fact that the hard seed of *V. villosa* are usually of the darker colors could not be used as a basis for segregating hard seed. While maturing, seed of *V. villosa* pass successively from green to dark brown and black. When exposed to germinative conditions, the coats of seed absorbing water changed to a lighter color. A method for the separation of hard seed consists in exposing the seed to germinative conditions and dropping individual seed on a porcelain plate. The hard seed sound like pebbles and seed not hard like green peas falling on such a surface. Hard seed and nonhard seed appeared to differ little in shape and size. Considerable variation was noted in the hard seed content of *V. villosa* from different sources.

In *V. villosa* high humidity during storage usually decreased the proportion of hard seed, while the reverse was associated with lower humidities. The rate of change in permeability of hard seed for any humidity was greatly accelerated by increased temperature. However, too long exposure of the seed to temperatures above 25° C. has affected germination detrimentally. It seemed possible to expose seed to any temperature up to 40° long enough to reduce the hard-seed percentage without interfering with germination. It appeared that the moisture content of a random sample of *V. villosa* might be used as a criterion of the hard-seed proportion. When the moisture is above 14 per cent the hard seed are usually reduced to a minimum.

Soil moisture seemed to influence the proportion of hard seed through its influence on the plant, the higher soil moisture producing maximum plant vigor and also resulting in the greatest proportion of hard seed. The potentiality for hard-seed production is probably inherited but appeared to be greatly influenced by environment. For 60 per cent soil moisture more hard seed was obtained from the progeny of selected impermeable seed than was found for the F_1 of permeable seed. The reverse held for 40 per cent soil moisture, while at 25 per cent the difference favored the selected hard seed.

Seed apparently mature at harvest showed more hard seed from the upper than from the lower parts of the plant, and a progression was also noted from the terminal toward the basal end of the pod in the proportion of hard seed. After laboratory storage, however, the differences in hard seed between these positions seemed to become less. Green seed removed from a plant exhibited no hard seed, giving a high percentage of germination, whereas such seed kept in the laboratory showed subsequently a considerable proportion of hard seed. Hard-seed formation appeared to be associated with dehydration processes which might proceed independently of the plant.

The change in proportion of hard seed through storage at different humidities and temperatures did not appear to be associated with any marked variations in carbohydrates. The impermeable character of the seed coat was not affected by ether but disappeared on short exposure to sulfuric acid or somewhat longer contact with moisture. Samples of hard seed had a smaller quantity of ash than seed taken at random, while their contents of carbohydrates, proteins, and fats were about equal.

Studies of the structure of the seed coat showed that probably the cuticle and the outer wall of the Malpighian layer are both concerned in the impermeable character.

Report of the Tobacco Substation at Windsor for 1928, P. J. Anderson and T. R. Swanback (*Connecticut State Sta. Bul. 299 (1929), pp. 141–203, figs. 8*).—Tobacco investigations are reviewed as heretofore (E. S. R., 59, p. 733) for 1928, and results over periods of different duration are summarized.

Potassium experiments to date showed that about 35,000 lbs. of potash per acre are present on the station farm in the upper 8 in. of the soil, which is typical of much of the tobacco section. This did not seem sufficiently available for the crop needs without yearly addition of fertilizer potash. Omission of all fertilizer potash affected the grading of the tobacco, a decline beginning the first year and the leaves becoming worthless in about three years. The data suggested the use of about 200 lbs. of potash per acre. While reduction in potash did not affect seriously the acre yield of tobacco, it injured fire-holding capacity and materially lowered the percentage of potash in the leaf. Substitution of potassium-magnesium sulfate for high grade potassium sulfate was of no advantage on the test soil. It lowered the grading and fire-holding capacity, did not increase yield, increased the magnesia and sulfur content of the leaves, and reduced the calcium and to a lesser extent the potash content.

In a comparison of the sulfate, carbonate, and nitrate of potassium, the carbonate gave the best grading and fire-holding capacity but the lowest yield, and the nitrate was satisfactory in general. The best results came from a combination deriving one-third of the required potash supply from each of the three carriers. The carriers did not influence the quantity of potash absorbed, and in four years did not change the soil reaction perceptibly. Potassium sulfate increased the sulfur content of the leaves, whereas the carbonate or the nitrate resulted in a decrease. Tobacco stems were also found to be a favorable potash source.

A slight reduction in fire-holding capacity was indicated when the entire nitrogen supply was from urea, but no reduction occurred when urea supplied one-half. Of the single nitrogen sources, ammonium sulfate resulted in the lowest fire-holding capacity, while that of tobacco receiving sodium nitrate or calcium nitrate was very high. Castor pomace had no unfavorable influence.

The use of a highly concentrated formula (28.5–0–28.5) appeared to cause a slight reduction in fire-holding capacity, it being uncertain which constituent was responsible. No significant differences were noted between sodium nitrate and calcium nitrate. As in previous crops, a distinct reduction in fire-holding capacity appeared where lime was applied heavily. On plats where tobacco has been grown unfertilized continuously since 1924 the leaf was short and very inferior, and the fire-holding capacity was equally inferior.

The average of 7,460 burn tests for 1927 was 54.6 seconds, as compared with 27.4 seconds for 5,400 burn tests on the 1926 crop, the difference evidently being due to the season. From application of fertilizer to the end of harvest, the rainfall in 1926 was 6.33 in. and in 1927 13.26 in., i. e., when the rainfall increased the fire-holding capacity was prolonged. It is suggested that the explanation probably lies in the distribution of the rainfall, particularly the time of occurrence of leaching rains.

The heavy rains for two successive years apparently so depleted the available supply of magnesia that sand drown was encountered even on light land. Its prevalence in 1928 possibly may be explained by the frequency of leaching rains during the growing season, resulting in constant removal of the magnesia as fast as it came into solution. While sand drown was worst where ammonium sulfate was the only nitrogen source, it was also quite common on sodium nitrate and calcium nitrate plats.

Laboratory trials suggested that 500 lbs. of sulfur per acre was about enough to cause an optimum increase of acidity in sandy soils. No optimum application was established for clay or organic soil, since the increased acidity corresponded quite uniformly to the quantities applied. Results from ammonium sulfate and aluminum sulfate and their combinations with sulfur, considering the large quantities used, did not favor a competition with sulfur alone for any of the test soils. In field trials sulfur increased acidity in all cases, the optimum effect coming from between 400 and 600 lbs. per acre. While on the average 500 lbs. of sulfur will cause a decrease in acidity of about 0.5 pH, on many soils a decrease of but 0.2 to 0.3 pH would be beneficial in order to approach the safety point for black root rot.

Results from urea tests were in accord with those of preceding years, indicating that one-half of the nitrogen of the formula could be derived advantageously from urea. Tests of one year with Calurea were in line with the results from urea. Calcium nitrate containing the same quantity of nitrogen as sodium nitrate has been similar in cost and otherwise, and, except for its somewhat greater deliquescence, did not differ significantly from the sodium nitrate in yield, grading, or fire-holding capacity. Of the single nitrogen sources, sodium nitrate leached so badly that tobacco yielded poorly and was very inferior in quality. The cottonseed meal plat also leached seriously, yet the cured tobacco, while yellow and lifeless, surpassed that from the sodium nitrate plats considerably. Ammonium sulfate plats yielded highest, but double colors made the quality poor. Urea plats did not leach, yielded slightly less than the ammonium sulfate plat, and the quality was best, but there was considerable sand drown.

Monthly soil tests over a year showed little change in the cottonseed meal plat, the urea plat slightly more acid, the sodium nitrate plat progressively more alkaline, the ammonium sulfate plat the most acid. Tobacco on manured plats remained greener and somewhat larger than on adjacent unmanured plats, and it had a better grade index and higher yield. As to the fractional application of nitrogen, results and observations showed that later nitrogen applications, if used, should be added just after the heavy rains before any fading of the leaf appears.

Every cover crop used increased the yield and improved the grade of tobacco grown thereafter. Rye gave the highest yield, and was closely followed by vetch and oats, and these three had the best grade index. Timothy, barley, redtop, alfalfa, and wheat, while not so beneficial as the others, were better than no cover.

Wisconsin Havana No. 142 was again highly resistant to black root rot and produced a heavier leaf yield than any of the ordinary Connecticut Havana Seed strains, although it appeared to suffer more from pole sweat. Tests with resistant strains of Broadleaf and Shade Cuban are noted briefly. Experiments at the station and in the sheds of growers of both Broadleaf and Havana Seed suggested that fire curing should be practiced generally by stalk growers in seasons when weather is conducive to sweat. Recommendations for fire curing based on the experiments are outlined.

Analyses showed that in every comparison liming reduced the percentage of total ash and of calcium, phosphorus, manganese, and potassium. Aluminum was reduced in some but not in all cases, whereas the percentage of magnesium was nearly doubled. It was suggested that the white ash and reduced fire-holding capacity found in tobacco from the limed plats are due to magnesium rather than to calcium.

In a study on the effects of magnesia, sulfur, and chlorine on the growth and quality of tobacco, H. F. Murwin of the U. S. Department of Agriculture reported that the necessity for including magnesia in the fertilizer mixture has been demonstrated. If the magnesia deficiency in the soil is not supplied by the fertilizer, both yield and quality of cured leaf may be greatly depressed. The quantity of magnesia taken up by tobacco was influenced by the quantity applied to the soil. Both chlorine and magnesia increased yields to a certain extent. While no great differences were noted in quality, the poorest tobacco came from control plats where neither magnesia, sulfur, nor chlorine were supplied. Chlorine nearly destroyed the fire-holding capacity of the cured leaf in these tests, whereas sulfur or magnesia were not obnoxious in this respect.

Bright tobacco in Georgia, J. M. Carr (*Georgia Coastal Plain Sta. Bul. 10 (1928), pp. 31, figs. 8*).—This is a revision of Bulletin 7 (E. S. R., 57, p. 433), with similar recommendations.

Bright tobacco culture in Georgia, E. C. Westbrook (*Ga. Agr. Col. Bul. 359 (1929), pp. 40, figs. 10*).—Intended for farmers in southern Georgia, information is given on the soils, rotations, varieties, cultural and field methods, harvesting, curing, storing, and marketing practices, and insects and diseases involved in the production of bright tobacco. The construction of a curing barn is described, with appropriate plans.

Varietal experiments with tobacco, T. C. McIlvaine and R. J. Garber (*West Virginia Sta. Bul. 216 (1928), pp. 16, figs. 3*).—Varietal trials in cooperation with the U. S. Department of Agriculture during four years at Lakin in the southwestern part of West Virginia, largely with sorts of Burley, showed that White Twist Bud, Red, Pepper, and Kelley had the greatest average values per acre. Kelley and Pepper were somewhat superior in quality to White Twist Bud and Red. Beinhart ranked high in yield and value during the three years tested.

[Weed control in Colorado], L. W. Durrell (*Colorado Sta. Rpt. 1928, pp. 22, 24*).—Germination studies revealed that not all of wild oat seed is dormant the first year. Weed seeds fallen to the ground were little affected by burning the dead weeds off the land or even by the burning of distillate sprayed on the ground. In the Laramie River Valley the destruction of sagebrush by burning, grubbing, and scraping has been followed by marked natural revegetation.

HORTICULTURE

Report of the horticulturist, E. P. Sandsten (*Colorado Sta. Rpt. 1928, pp. 36, 37, 38*).—Progress is noted in the garden pea improvement project, selections in the Dwarf Telephone variety having yielded one superior strain apparently well adapted to high altitudes. Of various plants tested as orchard cover crops, winter rye was found uniformly beneficial for peaches and sweetclover for apples. Fertilizer studies conducted at Avon with vegetables indicated the superior value of stable manure, commercial fertilizers proving neither profitable nor economical.

[Horticultural investigations at the Georgia Station] (*Georgia Sta. Rpt. 1928, pp. 16, 27–33, fig. 1*).—The usual annual report (E. S. R., 59, p. 229).

Sweet corn breeding resulted in the development of a vigorous new variety from crosses between Country Gentleman and a dent corn.

Of 60 odd varieties of Rubus under test, the Young dewberry proved outstanding on account of vigor and high yielding capacity. The most productive blackberries were French Lawton, Eldorado, Mersereau, and Crandall in the order given. Van Fleet, June, St. Regis, and Golden Queen were the most pro-

ductive raspberries. An examination of pecan pollen showed that there is seldom any deficiency in quantity but that quality varies. The results of studies upon the causes of unfruitfulness in pecans are again reviewed (E. S. R., 60, p. 542). Storage studies with pecans indicated that these nuts may be kept over a long period under suitable conditions which include (1) proper curing before going into storage, (2) a storage temperature of 30° F. with very slight variation, and (3) clean and dry storage air at all times. Observations on nuts after two years of cold storage showed negative Schiff's aldehyde and Kreis tests. The index of refraction at 20° C. increased from 1.4717 to 1.4735. The acid value increased from 0.3 to 0.6, and the iodine value from 111 to 121.5. It is suggested that nuts when removed from cold storage should be warmed gradually in a dry atmosphere to remove moisture.

Records taken on 11 varieties of tomatoes showed Gregory to be earliest, Earliana most productive, and Marglobe most resistant to wilt. Dusting with copper-lime was more effective than spraying with Bordeaux mixture. Fertilizers high in phosphates and nitrates were most effective.

Studies of the causes of cull peaches showed small size to be a potent factor in certain varieties, degree of ripeness in Hiley, and curculio, especially in the Belle and Elberta varieties. Rains during the ripening season stimulated the development of various troubles, such as brown rot, bacteriosis, crack, and curculio. In the Commerce and Cornelia districts the oriental fruit moth was a serious factor.

[**Horticultural investigations at the Kansas Station**] (*Kansas Sta. Bien. Rpt. 1927–28, pp. 56–60, 133*).—Acid lead arsenate was more effective than calcium arsenate in controlling codling moth on apples, a fact explained in the light of a closer union between arsenic and calcium, leaving less soluble arsenic available. More stung apples were recorded on the sprayed than unsprayed trees, although the number of wormy apples was less, indicating that worms had penetrated the skin before death occurred. Volck used alone was found incapable of controlling codling moth, but when combined with lead arsenate gave favorable results, apparently acting as an ovicide. Volck Kleenup spray gave satisfactory control of San Jose scale. Oil sprays gave better results than did lime sulfur.

Attempts to remodel bearing trees which had too many scaffold and secondary branches gave favorable results in amount and grade of fruit, but such cutting increased the hazard from blister canker. Studies with commercial fertilizers, cover crops, and mulches showed varying effects on the growth and fruiting of apple trees. Nitrate of soda and phosphate gave the largest yields among fertilizer plats, but potash alone was practically as beneficial. Jonathan trees fertilized with phosphates showed no consistent gain above the checks. Straw mulch was superior to cultivation, both in respect to yield and growth. During a severe drought in 1926 the minimum moisture content of the soil under mulch was 18.5 per cent on a dry weight basis as compared with 15 per cent in cultivated areas. Winter vetch and rye were more successful cover crops than were cowpeas and rape. Checking up the relation between soil moisture and soil nitrates, it was observed that nitrate content was much less variable in years of favorable rainfall than in years of drought. In the dry year of 1926 low nitrate content and low moisture were recorded in all plats during the period of twig extension, but thereafter nitrates increased very rapidly, while moisture continued to decline. Plats with rye as a cover crop averaged lower in available nitrates than did the controls, while winter vetch increased nitrates regardless of the time of plowing.

Comments are given on the results of variety tests of various tree and small fruits. In 1926 no marked differences were recorded in the yield of grapes trained in various manners, but in 1927 the fan system was significantly superior, followed in order by the four-cane Kniffin, Munson, and two-cane Kniffin. Studies of the correlation between growth and yield in the grape showed so little correlation in respect to diameter of cane and yield in the Worden that cane selection is deemed unessential. To a certain extent with Worden and more so with Concord, cane length was positively correlated with yields. Beneficial effects were obtained from the use of fertilizer on greenhouse lettuce. At the Fort Hays Substation the sour cherry produced crops for seven successive years, while during the same period apples produced one partial crop, pears two medium crops, plums two crops, and apricots only a few inferior fruits.

[Horticultural investigations at the New Hampshire Station] (*New Hampshire Sta. Bul. 238 (1929), pp. 12–14, 16, 22–24, 25, 26, 27*).—The usual annual report (E. S. R., 59, p. 229).

Analyzing records obtained in the nineteenth year of the Woodman Baldwin orchard experiment, G. F. Potter found that trees in permanent sod, trees cultivated in alternate years, trees cultivated every year, trees cultivated annually and receiving 2 lbs. of nitrate of soda per tree, and trees cultivated annually and receiving 6 lbs. of nitrate averaged, respectively, 40, 66, 76, 124, and 152 lbs. of fruit. Fertilizer had materially affected yields and the productive life of the trees to which it was applied. A single year's records taken upon the influence of the time of application of nitrogen upon fruit bud formation in the Baldwin, Rhode Island, and McIntosh apples failed to show any consistent differences in respect to flower formation, percentage of set, yield, or size that might be associated with the treatments. Baldwin trees fertilized in midsummer with a supplementary application of nitrate yielded more fruit than did check trees, but the differences were found hardly significant.

A statistical analysis of the results of chemical studies made by Potter and T. G. Phillips upon the spurs taken from 26 plats of Baldwin trees showing a wide range, from 2 to 60 per cent, in fruit bud formation indicated that a primary relation with fruit bud formation could be established only with size of spur as measured by dry weight or soluble and insoluble solids and with the percentage of nitrogen present, soluble, insoluble, or total.

According to records obtained by L. R. Tucker, the greatest terminal twig growth of Baldwin apple trees is made in the fruiting year. The maximum fruit bud formation takes place on nonfruiting trees, with nonfruiting limbs of bearing trees next, and practically none in the case of bearing limbs on bearing trees.

Investigations conducted by H. A. Rollins upon Baldwin trees carefully paired for similarity in size, set of fruit, and environment showed that thinning increased size of fruits and amount of color but decreased total yields and was not profitable. The thinning was done in late July and early August.

Storage studies conducted by L. P. Latimer upon Baldwin apples showed cold storage, from 31 to 32° F., to be more effective in retarding ripening than was ordinary storage. Large fruits ripened sooner than small in both storages and were more attractive and better flavored. Electrical resistance of the apple tissue was lowered about 10 per cent during the first two months under both environments. This depression was followed by a rise for six weeks followed again by a decrease for a similar period, after which there was no further change in the apples in cold storage. However, in ordinary storage there was a large increase in resistance between April 15 and June 20. Size of fruit had

an appreciable influence on resistance, being greater in the smaller fruits. As determined by the pressure test, the apples in common storage were generally softer than those in cold storage. Size of fruit had no consistent effect on pressure readings. The curves of pH values were practically identical for apples stored in both common and cold storage, and size of fruit had little influence on pH reaction.

As determined by S. R. Shimer, none of the apples of the 1927 crop carried lead or arsenic in amounts approaching the limits of the British tolerance.

Working with plum varieties, Latimer found the Japanese types to be generally unprofitable, while European varieties commanded ready sale. The Lombard proved the heaviest producer among Europeans.

In the apple pruning experiment conducted by Potter, production was slightly less on trees of the full leader type than on those pruned to the semileader or vase form. Apparently the type of pruning required to develop a full leader reduced the bearing area. Weights taken on prunings showed slightly more from the full leader trees than from the modified leader trees, both being much heavier than from the vase form trees. A total of from 15 to 20 lbs. of prunings per tree for the first 10-year period proved adequate to shape the trees to the modified leader form.

Peach trees responded notably to nitrogen, the increase from a 2-lb. application of nitrate of soda per tree being 24 lbs. of fruit. Contrary to previous results, potash supplements to nitrogen failed to increase yields above those from nitrogen alone.

Howard 17 strawberries receiving a basic treatment of 20 tons of manure per acre failed to respond notably in yield to additional treatments, the greatest gain, 10 to 15 per cent, being on plats fertilized with 20 additional tons of manure per acre. The double manure treatment developed the most new plants and produced the largest berries, but the increase was offset by less blooms per plant. Superphosphate, 1,500 lbs. per acre, increased the number of new plants by 20 per cent as compared with 30 per cent for the double-manure treatment.

In apple pollination studies, Latimer found that McIntosh is self-sterile under New Hampshire conditions, depetaled but uncovered flowers setting no fruit. Gravenstein was found self-sterile and Wealthy self-fertile under the same conditions. Wagener pollen proved effective for Gravenstein. Red Astrachan and Oldenburg produced fruit on flowers which were bagged but not emasculated, but Baldwin, McIntosh, Delicious, and Gravenstein pollen produced no set under any conditions. The emasculation process apparently reduced the set.

Observations by J. R. Hepler upon the yield and growth of F_1 hybrid tomatoes indicated that these are notably more vigorous and productive than the parental types. The increased yields were due to a larger number of tomatoes, which averaged somewhat smaller than those of the parents, often being comparable in size to the smaller-fruited parent.

Comparing large applications of manure with smaller applications supplemented with commercial materials, Hepler found but little difference in the yields of cabbage. Lime applied in alternate years failed to influence yields. No significant differences were observed between nitrate of soda, urea, ammonium sulfate, potassium nitrate, Leunasalpeter, and Calurea as nitrogen fertilizers for carrots. Slight increases were obtained with calcium nitrate and Nitrophoska.

S. Dunn working on the problem of determining hardiness of apple wood by the aniline dye adsorption test found that McIntosh, well known for its hardiness, was most hardy by the test and that the Baldwin was the least or next to the least hardy. With cabbage, hardened plants adsorbed more of the dye than did tender plants. Alfalfa was also tested.

[Horticultural investigations at the Tennessee Station], C. A. MOOERS and S. A. ROBERT (*Tennessee Sta. Rpt. 1928, pp. 29, 30, 44, 45, 46, figs. 4*).—*Rosa odorata* is considered a good stock for bush roses. The Manetta, commonly used by commercial propagators, was proving to be one of the weakest stocks tested. Material progress was made in the selection of wilt-resistant and uniform strains of cabbage. At the West Tennessee Substation tomatoes fertilized with 340 lbs. of a 4–11–5 fertilizer gave greatly increased yields. The wilt-resistant Tennessee Pink Beauty gave excellent results. Pruned blackberry plants yielded better than unpruned.

Mushroom culture for amateurs, V. K. CHARLES (*U. S. Dept. Agr., Farmers' Bul. 1587 (1929), pp. II+17, figs. 8*).—Treated in a general way, information is presented on the differences between edible and toxic forms, the use of cellars and other buildings as cultural sites, preparation of the beds, spawn and its planting, ventilation, harvesting, marketing, disease and insect pests, nutritive value, and general prospects for amateur culture.

Peppermint and spearmint as farm crops, A. F. SIEVERS (*U. S. Dept. Agr., Farmers' Bul. 1555 (1929), pp. II+26, figs. 17*).—This bulletin, superseding an earlier number (E. S. R., 34, p. 151), discusses the distribution of the peppermint and spearmint crops, botanical characteristics, soil requirements, culture, harvesting, distillation, and various economic considerations.

Pollination of greenhouse tomatoes, H. W. SCHNECK (*New York Cornell Sta. Bul. 470 (1928), pp. 60, figs. 31*).—In studying the effects of five different pollination treatments, namely, (1) emasculation with pollination, (2) watch glass pollination, (3) brushing, (4) jarring, and (5) no treatment, on the setting and development of tomato fruits in the greenhouse the author established the fact that certain of these treatments are not only highly beneficial but sufficiently profitable to warrant their use by commercial growers. Subtracting the costs of the treatments, the net value of the total crop was more than doubled in the case of the first two treatments and materially increased by all treatments as compared with undisturbed plants. The outstanding differences were secured in the early fruiting period, values for the first four weeks being five times as great for the emasculated and watch glass treatments as for no treatment. Jarring was better than brushing at all seasons, based on net profits.

Varieties differed markedly in their response to treatment. Of the five kinds tested, Globe, Comet, Bonny Best, John Baer, and Beauty, the Globe produced the highest and the Comet the lowest returns with every method. The treatments not only increased the set but also the size and quality of fruits. The watch glass, emasculation, and jarring methods increased size 41, 46, and 22 per cent, respectively, over that of no treatment, the greatest influence being on the first three clusters. Blossom-end rot was found more prevalent on the emasculated and watch glass treated plants, but is believed due to the greater drain of the large crop on the available moisture. In concluding, the author recommends as a common practice the pollination of the first three or four clusters by the watch glass method, after which jarring may be relied upon.

Combination insecticide and fungicide sprays, C. R. CUTRIGHT (*Ohio Sta. Bimo. Bul., 14 (1929), No. 2, pp. 42–44*).—It is pointed out that oil sprays, both emulsions and miscible oils, that are emulsified or stabilized with soap or ammonia can not be used safely with liquid or with dry lime sulfur, but that oils emulsified with water-soluble colloids, such as milk, starch, flour, glue, gelatin, and casein, or with insoluble colloids, such as clays and fuller's earth, can usually be mixed with lime sulfur and that the majority of oil emulsions and miscible oils are compatible with Bordeaux mixture and soluble sulfur. Summarized notes are presented on the results of spraying experiments at

various Ohio points in which these combinations were tested. Most of the materials used caused no injury up to the time that the first leaves were 0.25 in. in length.

Spraying fruit plants, W. F. PICKETT and W. R. MARTIN, JR. (*Kansas Sta. Circ. 145 (1929), pp. 32, figs. 17*).—In this revision of an earlier circular (E. S R., 55, p. 238) there are included spray schedules for various fruits, and information on disease and insect pests, spraying equipment, and spray materials.

Cranberry growing in Washington, D. J. CROWLEY (*Washington Col. Sta. Bul. 230 (1929), pp. 47, figs. 13*).—General information is presented on cranberry production in Washington, discussing the selection and preparation of the bog, varieties, planting, pruning, control of weeds, prevention of frost injury, insect and fungus pests, spraying, harvesting, marketing, and storage. A table is presented showing the various fungi isolated from decayed cranberries. Spraying investigations indicated that two Bordeaux sprays, namely, at the hook stage and the blossom stage, greatly reduced the percentage of storage rots, the benefits being especially noticeable during years of poor keeping quality.

A comparison of four systems of pruning grapes, D. FAUROT and T. J. TALBERT (*Missouri Sta. Research Bul. 121 (1928), pp. 35, figs. 10*).—Of four types of pruning, (1) single-trunk Kniffin, (2) Y-trunk Kniffin, (3) recurve, and (4) high renewal, the best results were secured with the first two. Based on five years' records the average total yields of five varieties, Moore, Concord, Hartford, Herbert, and Champion, averaged 3.116, 3.127, 3.068, and 2.462 tons per acre for the four systems, respectively. In both the single-trunk and the Y-trunk Kniffin the canes on the upper wires outyielded those on the lower wires, leading to the practical suggestion that one or two more buds may be left on these upper canes because of their greater capacity for production. Some indication was obtained in favor of pruning in January, as being better in respect to yield than either earlier or later. For example, a gain of 0.68 ton of grapes per acre was recorded for the Concord variety in favor of January over March pruning. Larger weights of prunings were removed from the high renewal and recurve trained vines than from the two Kniffin systems. The largest total yields in the Concord variety were secured from vines pruned to 60 buds. Concerning the relation of length of cane to production, from 9- to 10-ft. canes on the upper wire and from 7- to 8-ft canes on the lower wire were most productive.

Grape culture in New York, F. E. GLADWIN (*New York State Sta. Circ. 110 (1929), pp. 10*).—A general discussion upon grape production, including the selection of sites and soil, preparation and planting, value of high-grade one-year vines, varieties, culture, fertilization, pruning and training, and miscellaneous practices such as providing for pollination, bagging of clusters, and thinning of fruits.

Almonds, A. B. FITE (*New Mexico Sta. Bul. 171 (1929), pp. 7, figs. 3*).—Based on the results of a variety test started in the spring of 1915, information is given on the blooming habits, cultural requirements, time of blooming, and varietal characteristics. In six of the seven years covered, practically all of the nuts were killed by frosts which followed blossoming, leading to the observation that the almond is useful only for ornamental or shade purposes in this region.

FORESTRY

[Forestry at the Kansas Station] (*Kansas Sta. Bien. Rpt. 1927–28, pp. 60, 132, 133*).—Evidence was obtained that western yellow pine is better adapted to heavy soils that are likely to be water-logged than is the Austrian pine. Furthermore western yellow pine continued its height development over a longer

period than did the Austrian. A total of 5,284 Chinese elm trees were distributed from the Fort Hays forest nursery in the spring of 1928.

[Forestry investigations at the New Hampshire Station] (*New Hampshire Sta. Bul. 238 (1929), p. 26*).—Studies by K. W. Woodward on the station forestry plats showed (1) that white pine on heavy clay soils is overtopped and crowded out by hardwoods within 10 years of seeding, (2) that Scotch pine is in every way inferior to red and white pines, (3) that pure white pine stands will yield a cord per acre per year in thinnings between the thirtieth and fiftieth years, and (4) that thinning of white pines benefits not only the quantity but the quality of production.

[Forestry investigations at the Wisconsin Station] (*Wisconsin Sta. Bul. 405 (1929), pp. 2–9, figs. 6*).—Studies in typical jack pine and hardwood areas of northeastern Wisconsin during the spring fire season showed a direct relation between inflammability of the prevailing forest fire fuels and weather conditions. Hazardous fire periods were preceded by low humidity and absence of precipitation. Moisture content of the litter varied directly with humidity of the air. Wind velocity was also a potent factor in the spread of fire. Humidity was higher at the forest stations than in the open, with intermediate conditions in cut-over lands. On the other hand light rains were more effective in the open, reversing the normal situation and giving a drier litter in the forest than outside. When the humidity dropped below 50 per cent old fires were apt to flare up unless absolutely extinguished.

Studies in the drainage districts showed more rapid growth of young, vigorous trees following drainage. Natural seeding also followed the lowering of the water table. Trees near the ditches showed the most significant acceleration in growth. It is pointed out that forestry thus gained from the large drainage enterprises now abandoned. Noticing that good quality white pine occurred on the Plainfield sandy soil area, it is concluded that the poor oak stands now existing may be replaced with valuable white pine.

An examination of some 20 forest areas in northern counties indicated that there has been a rapid growth since the time of cutting, from 10 to 35 years ago, except where forest fires have occurred.

Experiments in the silvicultural control of natural reproduction of lodgepole pine in the central Rocky Mountains, C. G. Bates, H. C. Hilton, and T. Krueger (*Jour. Agr. Research [U. S.], 38 (1929), No. 4, pp. 229–243, figs. 6*).—Experiments in the Medicine Bow and Gunnison National Forests located in Wyoming and Colorado, respectively, led to the conclusion that lodgepole pine reproduction is easily obtained on sites of medium to good quality without resorting to burning. Studies in partially cut stands and in clear-cut areas emphasized the value of a cutting system which leaves clean-cut strips. Reproduction under partly cut stands was apt to be patchy and irregular. The cones left on the tree tops in the slash were evidently adequate in number to supply seed for reproduction. The slash apparently exerted a repressive influence on reproduction equivalent on many areas to a thinning operation and preventing very dense stands. In case of a great supply of cones it is suggested that part of the slash might be burned. On southern sites where lodgepole reproduction is often scattered it is believed that the repressive effects of slash would be slight. It is suggested that slash be left wherever the fire hazard is not greatly increased by its presence.

Relation of quantity of seed sown and density of seedlings to the development and survival of forest planting stock, W. G. Wahlenberg (*Jour. Agr. Research [U. S.], 38 (1929), No. 4, pp. 219–227, figs. 3*).—Observations at the Savenac Forest Nursery, Montana, showed that for the best development

of seedlings there should be less than 80 2-year-old western yellow pines, less than 160 2-year-old western white pines, and less than 120 3-year-old Engelmann spruce seedlings per square foot. The density of western yellow pines one year old varied directly with the amount of seed sown per given area. Using 80 1-year-old seedlings of western yellow pine as a standard number per square foot, diameter decreased 0.1 mm. for each increase of 44 plants. Height of seedlings and number of rootlets per plant also diminished with increased density. The percentage of distinctly inferior 2-year-old plants increased by one for every increase of 15 per square foot. Survival and growth in the field were deleteriously influenced by crowding in the seed bed.

Similar observations made on western white pine showed the same general trend, although the suitable number per square foot was much higher. In the case of 3-year-old Engelmann spruce occurring at the rate of from 116 to 323 per square foot, increases in density were accompanied by decreases in length and diameter of stems, in length of needles, and in weight of the tops and roots. These deficiencies offset the advantage of a greater ratio of root to top in the closely planted seedlings. Frost nipping of spruce decreased but heaving increased with increased density. As in the case of western yellow pine, survival and growth in the field were better with plants that had been widely spaced in the seed bed.

Deterioration of wind-thrown timber on the Olympic Peninsula, Wash., J. S. Boyce (*U. S. Dept. Agr., Tech. Bul. 104 (1929), pp. 28, pl. 1, figs. 11*).—Repeated observations upon fallen trees of Douglas fir, western hemlock, Sitka spruce, western red cedar, and silver fir blown down on the Olympic Peninsula, Washington, in the catastrophic windstorm of January 29, 1921, showed the most rapid decay in western hemlock and silver fir. By the summer of 1926, gauged from the standpoint of utilization, these two species were already a total loss, Sitka spruce had three or four years of possible use, while Douglas fir and western red cedar, especially the latter species, had indications of merchantable value for many years. On the basis of cubic foot volume, the total losses up to 1926 were 22, 34.2, 41.7, 55.8, and 68.4 per cent, respectively, in western red cedar, Douglas fir, Sitka spruce, silver fir, and western hemlock.

A study of the causes of decay showed that the ambrosia beetle and blue stain of sapwood were most important during the first three years, but from then on decay became an increasing factor. Altogether sporophores of 16 species of wood destroying fungi were identified in the fallen trees. Only three fungi occurred in western red cedar, and one of these, *Polystictus cuneatus*, was confined to this species and was responsible for most of the decay. Sporophores of *P. abietinus* followed in order by those of *Fomes pinicola*, *Lenzites sepiaria*, and *F. applanatus*, occurred on the greater number of trees. *F. pinicola* caused the greatest total loss.

The economic aspects of forest destruction in northern Michigan, W. N. Sparhawk and W. D. Brush (*U. S. Dept. Agr., Tech. Bul. 92 (1929), pp. [1]+120, figs. 51*).—Defining forest destruction as the handling of the forests of a given economic unit in such a way as to render them incapable of continuous production in fairly steady quantities, the authors discuss the situation in northern Michigan where millions of acres of unproductive cut-over land present a great economic problem, not only from the forestry viewpoint but from that of the public welfare. Accompanying the exhaustion of the forests there has been a loss in population, withdrawal of railroads, and loss of markets for locally produced farm products. The tax burden has greatly increased on the remaining inhabitants.

Pointing out that much of this cut-over land has no immediate value from an agricultural standpoint, the authors stress the need of restoring the forests. The first and greatest step is the prevention of fires which prevent natural regeneration as well as causing actual loss.

Citing the notable progress that Michigan has already made in the purchase of State forests, in fire prevention, and in the development of helpful laws, the authors outline a further program which includes a State planning commission, further extension of the State, county, and municipal forests, and the encouragement of private forestry. Under a system of forest management which would insure continuous production the authors believe that the forest lands could again become profitable and support a permanent population, not only of forest workers and their families, but also farmers and industrial employees.

Cutting the farm woods "profitwise," R. D. GARVER (*U. S. Dept. Agr. Leaflet 30 (1928), pp. 4, figs. 3*).—Including a table of grades, volume, and value of lumber in sugar maple trees of diameters ranging from 9 to 26 in., the author points out the value of a selective cutting system which removes the mature and undesirable trees and leaves the younger, rapidly growing trees.

DISEASES OF PLANTS

Plant diseases (*Georgia Sta. Rpt. 1928, pp. 23–27*).—Investigations of the relation of spermatia to the life history and propagation of certain Ascomycetes are said to have shown that these bodies are regularly produced by about 25 species of the group, but all attempts to germinate them failed, and the evidence is believed to indicate that spermatia are not propagative spores but are probably male sexual elements. Whether they were functional or vestigial was not determined.

Breeding experiments to secure varieties of tomatoes resistant to Fusarium wilt were interfered with by reason of the occurrence of mosaic, and the presence of the latter disease seemed to increase susceptibility to wilt.

In investigations of peach rosette a number of organisms were isolated from infected twigs, but inoculation experiments failed to show symptoms of the disease. Rosette was readily produced by budding, but the development was so slow as to suggest that the infective principle was inactivated by high summer temperatures or the low concentration of the nutrients during the growing season.

Experiments are reported on seed treatments with fungicides for the control of *Sclerotium rolfsii* on peppers, and one preparation used gave results that were considered promising.

Tests of various dust and liquid treatments of cottonseed showed that angular leaf spot could be controlled, but delinting seed with sulfuric acid followed by treatment with corrosive sublimate solution reduced the stand during a cool, wet spring. It was found that surface disinfection of the seed could be accomplished with a number of dust disinfectants.

In experiments for the control of downy mildew of cucurbits severe injury to foliage followed the use of some of the sprays. Copper acetate solution was considered promising as a spray material for cantaloupes. Colloidal copper gave good control of the disease, but the fungicide burned the foliage severely. Copper-lime dust did not give good control.

Diseases of plants (*Kansas Sta. Bien. Rpt. 1927–28, pp. 60–67*).—Summary accounts are given of investigations on some of the diseases of cereals and forage crops and of fruits and vegetables and on the resistance of wheat to leaf rust.

In the studies of wheat smut, early plantings in September are said to have resulted in little or no smut, while plantings in October and up to the middle of November gave the highest infection. Soil temperatures between 40 and 60° F., together with sufficient moisture, appeared to be the most favorable conditions for smut infection. Copper carbonate having from 50 to 55 per cent metallic copper was more efficient for controlling wheat smut than those with a lower percentage when used in equal amounts. Formaldehyde as a soaking or sprinkling treatment was more efficient than any of the grades of copper carbonate in controlling smut when the seed was heavily infected. Two years' work is said to have indicated that heavy soil contamination resulted in smut infection, although the seed had been treated with copper carbonate.

In investigations of oat smut, indications were found of physiologic strains of the fungus, and some of them were apparently more pathogenic on Kanota oats than on other varieties. The formaldehyde mist method proved the most practicable, efficient, and inexpensive treatment for the control of oat smut. None of the fungicidal dust treatments were satisfactory for the control of smut in hulled varieties of oats.

The finer grades of sulfur dust were nearly as efficient as copper carbonate for the control of sorghum kernel smut, and the high and low grades of copper carbonate were about equally effective. The heaviest smut infections of sorghum occurred in plantings made in May, while those made in April and in June contained only a small amount of smut. Evidence was obtained that indicates that there are at least two physiologic strains of the sorghum kernel smut, each of which was found also to attack milo, hegari, and feterita, which had been regarded as immune. The strain of smut attacking milo and hegari was controlled by copper carbonate, but experiments with feterita smut were not conclusive.

Corn smut investigations are said to have shown that the date of planting inbred lines did not change their reaction toward smut. A number of resistant strains of corn have been produced, and while they are highly resistant or free from smut in the field they proved to be susceptible when hypodermically inoculated. Dusting sweet corn with copper carbonate and sulfur dusts at frequent intervals reduced the amount of smut, although it did not completely control it.

Two seasons' results are said to have shown that millet smut can be completely controlled by copper carbonate, and sulfur dusts were ineffective.

In the investigation of alfalfa diseases, studies were made of winter injury and a new disease of alfalfa due to *Fusarium oxysporum medicaginis*. Field studies showed that bacterial wilt caused by *Aplanobacter insidiosum* and winter injury were the principal causes for destroying stands of alfalfa.

In studying the wheat foot-rot disease, investigations were made of *Ophiobolus graminis* and *Helminthosporium sativum* with reference to their ability to withstand cold. Fertilizers when mixed with naturally infested soil had a marked effect on the severity of foot rot on wheat. Some evidence was obtained that indicates that heat and dryness during the summer may partially sterilize the soil with respect to foot-rot organisms.

For the control of the Rhizoctonia disease of potatoes by seed treatment, the hot formaldehyde method gave the best results. Copper dusts were found to delay germination and did not control the fungus. Organic mercury compounds were more expensive and did not control Rhizoctonia as well as formaldehyde.

For the control of potato scab, sulfur and sulfur and green manure were tested, but none of the treatments increased soil acidity so as to appreciably reduce the amount of scab.

Investigations of potato blackleg are said to have confirmed the claim that the causal bacteria are carried by the seed tubers and disseminated in the field by the corn seed maggot. Dusting the seed pieces with mercury poisons reduced the infection by destroying the maggots. Late season infections were found to occur most commonly on plants attacked by Rhizoctonia, indicating that by controlling that fungus blackleg infection will be reduced.

Studies of spindle tuber showed that the yield was reduced by from 25 to 60 per cent by the occurrence of the disease, and that the virus was transmitted through the cutting knife and by certain insects.

Tests were made of 10 varieties and 48 selections of tomatoes for resistance to Fusarium wilt, with inconclusive results due to storm injury. In 1927, 60 per cent of the plants of the variety Kanora were infected when grown in wilt-infected soil.

Observations on 38 varieties of apples showed that Northwestern, Yellow Transparent, and Winesap were most resistant to cedar apple rust, while Wealthy and Jonathan were highly susceptible. Adequate control of the rust was not obtained by dusting apple trees with sulfur during the time the spores were being discharged from the cedar galls.

A progress report is given of experiments carried on cooperatively with the U. S. Department of Agriculture and the Oklahoma and Texas Experiment Stations on the control of leaf rust of wheat. A number of promising hybrids and selections have been produced that are said to be resistant to leaf rust. Studies of the oversummering and overwintering of the rust showed that it lived over summer in Kansas on volunteer wheat and occasionally passed the winter on wheat as far north as Manhattan. The early spread of the rust is believed to come from Oklahoma and Texas where the fungus overwinters in abundance. A study of leaf rust collections is said to indicate that physiologic form 9 was the most widely distributed and abundant in the Southwest, although other forms were found. Inheritance studies of 15 crosses through 3 generations showed that freedom from rust, or a high type of resistance, was recessive in most cases. No linkage was found between resistance to leaf rust and any morphologic character in crosses between varieties of common wheat. In tests of about 200 varieties of wheat in the greenhouse, resistant strains were found in winter and spring, awned and awnless, and soft and hard kerneled type. Most of them were found among the soft red winter varieties.

Several varieties and many hybrid lines of wheat were found to be susceptible to form 9 in the seedling stage of growth and highly resistant to the same form at heading time.

[Plant disease studies] (*Tennessee Sta. Rpt. 1928, pp. 25–28, 32–34, figs. 7*).—For the control of pear blight, the species *Pyrus calleryana* has proved to be one of the most blight-resistant stocks tested in Tennessee, and in addition it is resistant to leaf spots, and therefore retains its leaves and can be budded throughout the growing season. *P. ussuriensis* was not found to be so resistant to blight, and it made poor growth under Tennessee conditions. *P. serotina* proved unsatisfactory because of its lack of resistance to blight and leaf spot.

Tests of garden beans showed that the use of disease-free seed was the only practicable way of controlling bean anthracnose.

Rhubarb crowns have been tested for rot, and the selection of clean, healthy roots where no rot is present is advised.

In spraying tests for the control of peach diseases, foliage was badly burned by lead arsenate used in combination with a proprietary sulfur spray. It was found that the lead arsenate could be safely used when combined with self-boiled lime sulfur or dry-mix sulfur lime.

Some experiments carried on at the station proved conclusively that the black rot of sweet potatoes continued to spread after the potatoes were harvested and placed in storage. As a result of this investigation, it is recommended that care should be taken to cull out all black rot from potatoes before placing them in storage.

In connection with brown rot of peach studies, the presence of mummies was found to be important in the spread of the disease, and the removal of mummies not only from peaches but from plums and cherries is recommended.

Brief notes are also given by C. D. Sherbakoff on cotton diseases of special importance in Tennessee and their control

New ways to control and prevent plant diseases (*Wisconsin Sta. Bul. 405 (1929), pp. 71–88, figs. 7*).—Studies by L. R. Jones and W. J. Zaumeyer are said to indicate that while breeding beans for resistance to the seed-borne diseases, blight, anthracnose, and mosaic, offers promise of success, better immediate results will follow the planting of beans grown in some of the drier regions of the West.

The moisture and temperature relations of a number of bacterial plant parasites were studied by A. J. Riker et al., and, under laboratory conditions, placing the plants in a saturated atmosphere for several hours before inoculation favored the development of angular leaf spot of cucumbers, bacterial blight of peas, wildfire of tobacco, bacterial blight of beans, and fire blight of apples. The optimum temperature for the development of angular leaf spot of cucumbers was found to be about 75° F., for wildfire of tobacco 82°, for leaf spot of corn 54°, for halo blight of oats 82°, and for tomato wilt 82°.

J. C. Walker is reported to have demonstrated that inheritance in cabbage of resistance to yellows is dominant to susceptibility, and it is governed by a single factor. Applying this principle, the station has produced two strains of early cabbage that are reported about 100 per cent resistant.

Experiments by Walker and F. L. Wellman showed that the application of from 1 to 2 tons of hydrated lime per acre was effective in controlling cabbage clubroot, but ground limestone, air-slaked lime, burnt lime, and gypsum were unsatisfactory.

In connection with studies on the occurrence of black rot of cabbage, Walker and H. R. Angell found that southern-grown plants were frequently a source of infection. It was also found that plants which show little infection may produce seed that will spread the disease. Treating seed with hot water (122° for 30 minutes) is recommended.

Investigations by Walker and L. J. Alexander have shown that *Corticium vagum* is the principal destructive parasite of sugar beets in Wisconsin, *Phoma betae* being of less importance. Tests have shown that some of the organic mercury seed disinfectants were promising for the control of these diseases.

Comparisons made by J. W. Brann and R. E. Vaughan of corrosive sublimate, hot formaldehyde, and some of the new compounds for the control of some potato diseases showed that the corrosive sublimate treatment gave the best control of Rhizoctonia and scab. The hot formaldehyde treatment was found to be the cheapest, but it is said that care is required in its use or germination will be injured. Germination and early growth of potatoes were stimulated by some of the proprietary compounds.

Experiments by Jones and R. S. Riker have shown that aster yellows can be prevented by growing the plants under cloth shelters, which excluded the leafhoppers, and the quality of the flowers was improved. Progress is

reported in the development of strains of asters that are resistant to Fusarium wilt.

Tests made by G. W. Keitt and E. E. Wilson during the cool, wet summer of 1928 are said to have shown that liquid lime sulfur (1-40) was again the most efficient fungicide for the control of apple scab. Sulfur dusts and dry-mix lime sulfur were less effective. Applications in addition to the delayed dormant, closed cluster, and open cluster sprays were found necessary for satisfactory control.

Greenhouse and laboratory investigations by J. M. Hamilton and Keitt are said to have shown that scab on leaves of potted apple plants was controlled when sulfur sprays were applied after infection began. Liquid lime-sulfur spray was effective when applied a longer period after infection began than any other sulfur sprays or dusts tried. Sulfur-arsenate dust showed little effectiveness when applied more than 12 hours after the infection period began, unless the dust treatment was followed by a moist period. Lime sulfur was commonly effective for 72 hours after the infection period began. Certain oil sprays exhibited marked fungicidal effectiveness. In the series of experiments it was found that lime-sulfur sprays and Bordeaux mixture were decidedly more adhesive than any of the other sulfur or dust treatments, oil sprays, or combinations tried. Potassium permanganate as an oxidizer for sulfur dust did not appear to increase its effectiveness but showed fungicidal action if used alone.

In a study of fire blight, P. W. Miller and Keitt found that there was no evidence to indicate that insects are important agents in the dissemination of the early spring infection, although they may play an important part in later ones. Rain was found to be the most important agent in spreading the disease from the hold-over cankers. Spraying potted plants in the greenhouse with suspensions of the fire-blight organism showed numerous instances of stomatal penetration of leaves, sepals, etc.

Studies of brown rot of cherries by Wilson and Keitt showed that infection took place when the trees were in bloom, and later the disease appeared on the green and ripe fruit. Brown rot of cherries was held in check in some instances when the trees had been sprayed for the control of leaf spot.

Continued studies on crown gall and hairy root by Riker, Banfield, and Keitt have shown that in some cases the organisms appeared to stimulate root development, and that there were distinct differences between those isolated from hairy root and crown gall (E. S. R., 60, p. 445).

Investigations of crown gall on raspberries showed that the organisms were being given off by the galls, and that the bacteria could persist in the soil for a year or more. Organisms from hairy root and crown gall on apple caused enlargements on the roots of the raspberry, but with symptoms differing from those on the apple.

The use of adhesive plaster or nurserymen's tape in place of waxed string for tying grafts was found to reduce the malformations about the graft union.

The environment during the maturation of grain was found by J. G. Dickson and K. P. Link to influence the blighting of seedlings. Field trials and temperature control experiments showed that strains of wheat that were resistant to seedling blight (*Gibberella saubinetii*) were readily attacked when the grain was produced at high temperatures. With corn, that produced at higher temperatures during the growth and ripening of the crop was more resistant to seedling blight than corn grown where cooler temperatures prevailed.

Chemical analyses of corn and wheat grown under different temperatures showed little differences in the endosperm composition, but there were marked differences in the embryos.

A severe epidemic of scab (*G. saubinetii*) in 1928 was reported by Dickson on wheat, oats, barley, and corn. All grains were found to be attacked with equal vigor. Clean seed, clean tillage, and crop rotation are recommended for controlling scab on these crops.

For the prevention of barley stripe, some of the new commercial dusts gave excellent results. For oat smut, control was secured with formaldehyde, basic copper-carbonate dusts, and some of the commercial dusts.

Organic mercury disinfectants failed to control seed-corn diseases in experiments by Dickson and A. H. Wright. Seed that showed no infection when tested gave better stands and yields than treated infected seed.

New ways to diagnose mosaic diseases (*Wisconsin Sta. Bul. 405 (1929), pp. 114–116, fig. 1*).—Microscopical examinations by I. A. Hoggan and J. Johnson of cell inclusions of tobacco and other solanaceous plants affected with mosaic are said to indicate their value for diagnostic purposes, but the inclusions are not considered to be of a causal nature.

Investigations by Johnson are reported to have shown that the viruses of different mosaic diseases may be separated and classified on the basis of certain properties, such as thermal death point, resistance to aging in cultures, tolerance to dilution, etc.

Studies of the peach aphid (*Myzus persicae*) as a carrier of the virus of tobacco mosaic showed that it was an agent in the transmission of the unimportant cucumber mosaic to tobacco but not of the more serious disease, tobacco mosaic. It is claimed that something is involved in aphid transmission besides a mere mechanical transfer of viruliferous juice from plant to plant.

Preheating seed to control bean anthracnose (*New Hampshire Sta. Bul. 238 (1929), p. 27*).—Investigations by S. Dunn are said to have indicated that bean seed treated at high temperatures without preheating at lower temperatures showed resistance to anthracnose. Healthy and diseased Red Kidney and Bountiful beans were preheated in different groups of samples at 50° C. for 20, 21, and 26 days and afterwards heated at 80, 85, and 90° for a period ranging from 2 to 18 hours. Heating periods of from 4 to 10 hours at the higher temperatures least hindered the growth of healthy seed, and all but a small percentage of the diseased seed was killed.

Potato experiments for the control of Rhizoctonia, scab, and blackleg, 1922 to 1927, R. P. White (*Kansas Sta. Tech. Bul. 24 (1928), pp. 37*).—On account of objections to the corrosive sublimate treatment of potatoes, investigations were made of other methods, and the author states that hot formaldehyde solutions of 1–120 strength applied at temperatures of from 124 to 126° F. will control Rhizoctonia satisfactorily, if the potatoes are immersed for a period of from 3 to 4 minutes. Lower temperatures or shorter periods of immersion did not, in general, give satisfactory control. Spring treatments shortly before planting, were found to cause dormancy in the tuber, which in turn delayed the emergence of the sprouts from the soil. The more severe the treatment, the greater the induced dormancy and the greater the delay in emergence. Fall treatments were found to be as effective in Rhizoctonia control as spring treatments, and they did not cause induced dormancy.

Scab, resulting from infections from the soil, was lessened by the use of green manures and sulfur. Green manures plowed under in the spring, shortly before potato planting, proved more efficient in scab control than green manure plowed under in the fall. No difference, in regard to scab control, was observed between inoculated and uninoculated sulfur at the rates used.

Certain organic mercury componnds gave satisfactory control of Rhizoctonia and blackleg when used as disinfectants.

Why does potato seed run out? (*New Hampshire Sta. Bul. 238 (1929), p. 8*).—Experiments by O. Butler on potato deterioration due to leaf roll and mosaic are said to have shown marked depreciation in planting stock at two places within 2 years, while practically none was shown at another station during a period of 7 years. In seeking an explanation of this, the relative mean temperatures at the different stations were compared, and it was found that the mean number of hours per day during which the temperature is below 10° C. (50° F.) is of some significance.

Fertilizers lessen injury from tobacco brown root rot (*Wisconsin Sta. Bul. 405 (1929), pp. 111, 112, fig. 1*).—Experiments by R. P. Thomas, J. Johnson, and E. Truog have shown that the disease of tobacco called brown root rot can be produced artificially by adding cellulose to good tobacco soil. This is believed to be due to the stimulation of cellulose-decomposing organisms, which take the nitrogen away from the crop. The reason why timothy sod is deleterious to tobacco is believed to be due to the large amount of cellulose and the low amount of available nitrogen. The application of nitrogen and phosphorus is recommended where tobacco is planted after timothy.

No deleterious effect has been observed in growing tobacco in soil continuously if there is no black root rot infection.

"Road-oil" injury to tobacco and other crops (*Wisconsin Sta. Bul. 405 (1929), pp. 113, 114, fig. 1*).—Where light asphalt or gas-house oils are used on dirt or gravel roads, serious injury to crops is said to have resulted from the dust blown on them. A study was made by J. Johnson of the type of injury, and it was found that the oil is ordinarily only slightly toxic or interferes with the respiration of the plant only to a moderate extent. Consequently necrosis does not occur or develops only as a secondary symptom. The growth of the leaf blade is, however, checked considerably, and growth cracks are produced between the veins of the leaf. The effect of the oil was found in some cases to extend more than 100 ft. from the roadside, and some crops were affected more seriously than others. Grain and corn appeared rather resistant to injury, whereas tobacco, potatoes, and most garden vegetables were relatively susceptible.

Three rust diseases of the apple, H. E. Thomas and W. D. Mills (*New York Cornell Sta. Mem. 123 (1929), pp. 21, pls. 2, figs. 3*).—Studies were reported of three distinct rust diseases of the cultivated apple in the Hudson River Valley of New York. These diseases are designated as apple rust caused by *Gymnosporangium juniperi-virginianae*, hawthorn rust caused by *G. globosum*, and quince rust caused by *G. germinale*. Both the quince and the apple rusts are said to cause direct and serious losses by infection of the fruit. The hawthorn rust was found to prove destructive on apple foliage only occasionally. Varieties of apples showed marked variation in their response to the diseases, both in type of symptoms and in severity of the disease.

Inoculation experiments are reported, in which the three fungi were transferred to the foliage of the varieties McIntosh and Wealthy. No infection was obtained with *G. germinale*. *G. juniperi-virginianae* easily effected ingress into the McIntosh leaf, as well as that of Wealthy, but it was usually checked in the McIntosh before pycnia were formed. *G. globosum* was found to infect McIntosh readily and Wealthy only with difficulty. For the control of these diseases, the eradication of red cedars is considered the best method. The application of fungicides was found to offer some promise in the control of fruit infection.

Sulfur dusts for the control of apple scab, H. C. Young (*Ohio Sta. Bimo. Bul., 14 (1929), No. 2, pp. 38–41*).—In studies made to determine the reason for

the frequent failure of sulfur dusts to control apple scab, it was found that a rain of 0.66 in. removed from 66 to 94 per cent of the sulfur. Heavier rains removed 90 per cent or more.

In comparing the toxicity of sulfur dusts, dry lime sulfur and several other sulfur dusts were studied, and an 85–15 sulfur and dry lime sulfur gave the best control, while finely ground sulfur was the least efficient.

Burgundy mixture for spraying (*New Hampshire Sta. Bul. 238 (1929), p. 30*).—Investigations by O. Butler were made of Burgundy mixture, using a 1:1.84 mixture. It was found that mixtures in which the ratio of copper sulfate to sodium carbonate was 1:1.5 or higher decomposed with the formation of malachite, while mixtures in which the ratio was 1:1 decomposed to form a blue copper carbonate. The effect on the dry matter formed in plants sprayed with Burgundy mixture showed that beans were somewhat injured, while with sunflowers there was an increase in the dry matter formed.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Report of the entomologist, C. P. Gillette (*Colorado Sta. Rpt. 1928, pp. 27–30*).—In work with the codling moth good results were obtained by W. P. Yetter, jr., through the use of vinegar traps for the collection of the moths in the trees and a specially prepared and treated band for the destruction of the larvae as they accumulate beneath the band on the tree trunks. In work with an egg parasite of the codling moth, by G. M. List and Yetter, several thousand parasites were sent to and released in orchards on the western slope.

In control work with the Mormon cricket under the direction of F. T. Cowan little damage was done to crops where directions were followed.

Injurious insects and other pests (*Kansas Sta. Bien. Rpt. 1927–28, pp. 67–82*).—This is a discussion of work with insects and related pests in Kansas during the biennium ended June 30, 1928.

Under the heading of climate and injurious insect investigations, it is reported as having been found that a light breeze in the codling moth cages set up by a ventilating fan was sufficient to prevent oviposition, and that when there was no perceptible breeze the moths readily oviposited just after sundown. These observations are said to have been corroborated in the field.

In investigating the temperatures of insects in respect to their position on the plant and the surrounding air, a thermocouple and some of the more common alfalfa insects were used. Three consecutive readings of the galvanometer were made of certain insects in the shade and in the sun on various parts of alfalfa or other plants. Temperatures of the soil just below the surface of plants and of the air at various heights above the surface of the soil were recorded. Lethal temperatures at the surface of the soil were determined for various species of insects and for several sizes of the same insects. The following tentative conclusions drawn from the observations appear to be indicated:

"Small insects died more quickly on the surface of the soil on hot days than did larger ones of the same kind. There is a difference among different species as to their ability to withstand the high temperatures of the soil. Insects living in the upper foliage of plants were less resistant to heat than those living lower down or on the ground. If larvae climbed up a stubble or plant, they could hold out successfully for hours, in the hottest weather, even though they were only a few inches above the surface of the soil. With soil temperatures from 120 to 150° F., they succumbed to the heat in from 30 seconds to around 5 minutes if placed on the bare ground. It appears that insects in the field often survive by climbing up the plants.

"Insects were not visibly affected when placed on the ground in the shade, though they were quickly killed when moved a few inches into the sun. The soil temperature was lower in the shade than in the sun. The temperature of an insect is slightly lower than air temperatnre. When the insect is killed this difference disappears. It is, therefore, possible to tell when an insect dies by watching only the galvanometer."

Experiments were conducted to determine the temperature and humidity inside of rearing cages, jars, lamp chimneys over plants, and similar confining appliances used in rearing insects. There was found to be little difference between the air temperatures, but the humidity within the cages, except in screen cages, was always high, approximating from 90 to 100 per cent. It is considered clear from the work thus far conducted that precipitation is a far greater factor in determining insect abundance than is temperature.

In reporting upon the Hessian fly it is stated that this pest has been spreading westward with the increase in the wheat acreage in the western part of the State, the western line of distribution having been extended to include Meade, Gray, Finney, and Scott Counties. There were found to be three distinct broods of fly in 1926, while five broods occurred in 1927. In dealing with this pest and other wheat insects, the life history of the Hessian fly in the field, reservoirs, and its history in Kansas, time of planting wheat, the influence of cultural measures on insect injury, food requirements of stored grain insects, an insect census of wheat fields, and true army worm in wheat are briefly considered.

Insects injurious to corn are taken up under the headings of corn ear worm investigations, chinch bug barriers, biological study of the corn leaf aphid, biological study of the southern corn rootworm, influence of cultural systems on insect injury, stalk borers and the western corn rootworm, and insect census of corn fields.

Referring briefly to fruit and vegetable insects, it is stated that a green flea beetle, *Haltica foliacea*, which caused much damage to nursery apple stock and young orchards early in the summer of 1926, can be controlled by the use of 5 to 6 lbs. of lead arsenate to 50 gal. of water, or a 4–4–50 Bordeaux mixture, which acts as a repellant. The diamond-back moth is said to have become a pest in the vicinity of Manhattan, but can be controlled by the use of 2 lbs. of lead arsenate to 50 gal. of water, with 2 lbs. of resin soap added for a sticker. Of several materials used in treating bands on apple trees as a supplementary control measure for codling moths, those made of β-naphthol and a medium lubricating oil gave the best results the first year.

Reporting upon control work with insects attacking sorghums, it is stated that Sudan grass, although not as suitable as native bunch grass serves as efficient hibernating quarters for the chinch bug. An examination of 604 bunches of Sudan grass taken from various types of fields and covering a period of 4 years showed a maximum of 540 bugs in a single clump, with an average of 21.1 live bugs per bunch. A summary of 3 years' work with the life history of the southern corn rootworm has shown the average length of the egg stage to be 7.9 days, the larval stage 30.7, and the pupal stage 12.1. Brief reference is made to a study of the relative effect of the various types of injury caused by the corn leaf aphid, a survey of the insects of the sorghum field, and a study of the insects infesting sorghum seeds in storage.

Reference is made to several insects attacking the roots of staple crops and to work with insects injurious to alfalfa and allied plants, as considered in a paper in Bulletin 242 (pp. 36–40) of this station (E. S. R., 58, p. 429). The small chalcid *Euplectrus platyhypenae* How., a parasite of the variegated cut-

worm never reported before from Kansas, appeared for the first time in the summer of 1926, and was found plentiful at Hays in July, but disappeared in August and has not since been observed.

In control work with insecticides for codling moth, lead arsenate alone was the best of the 9 insecticides tested, in both years, a 3–50 solution giving a reasonable control. In banding work, in which a number of chemicals were tested, the oil β-naphthol, with 85 per cent kill, gave the best results.

In studying the resistance of crop plants to insect injury chinch bug experiments were conducted, and evidence was secured to show that probably the dissolving action of the salivary fluid plays an important part in enabling the chinch bug to puncture the plant cells. Studies of the resistance of wheat to Hessian fly, conducted in the greenhouse, seem to supply some evidence of three kinds or expressions of resistance.

Brief reference is also made to investigations in the control of injurious rodents.

Montana insect pests for 1927 and 1928, J. R. PARKER and W. B. MABEE (*Montana Sta. Bul. 216 (1928), pp. 23, figs. 6*).—Following a brief preliminary discussion of entomological work in the State, an account and list are given of the insect pests of 1927 and 1928. During these years only one insect outbreak of major importance occurred, namely, that of the Mormon cricket in Lake and Sanders Counties. The parasites of this cricket include the large sphecid wasp *Palmodes laeviventris* Cress., observed in the fall of 1926. As many as five parasitized crickets were taken from a single burrow, each one, however, separately buried with an individual egg. The other cricket parasite is *Sparaison pilosum* Ashm., which attacks the eggs.

The Bertha army worm, *Barathra configurata* Walk., first made its appearance in the State in outbreak numbers during the late summer and fall of 1928. Major damage was done to alfalfa, but sugar beets in the Ronan district and cabbage plants in one field in Gallatin County also suffered.

In work with mosquitoes a study has shown 38 different species to occur in the State, 4 of which, namely, *Aedes spenceri* Theo., *A. nigromaculis* Ludl., *A. vexans* Meig., and *A. dorsalis* Meig., were responsible for the majority of the complaints received. Fine control was secured until about the middle of May, when irrigation was started on a large scale.

The golden spider beetle (*Niptus hololeucus* Fald.), a household pest, was found for the first time in the State at Butte. This beetle is a native of Asia Minor, now occurring as a general household and stored-product pest throughout Europe. In North America one specimen of this insect was recorded from Halifax in 1899, an infestation was found in Montreal in 1904, and another in Boston in 1920.

[Economic insects and their control in New Hampshire] (*New Hampshire Sta. Bul. 238 (1929), pp. 21, 22, 26*).—The work of eliminating mosquitoes from coastal marshes by P. R. Lowry is briefly referred to. Thirty-seven species of mosquitoes are said to have been found in the State, of which 20 attack man, and 11 of these are prevalent along the coast, where the salt marsh species is by far the most numerous.

It was found by W. C. O'Kane that the European corn borer did not increase in numbers during the fifth year of the investigation.

Studies of the life history of the white pine weevil by O'Kane were completed. It was found that some weevils live for two years, and if the number of individuals that represent this lengthened cycle is sufficient it may account for some of the failures to secure control by elimination of infested white pine leaders at the time weevils are in them in the larval or pupal stages. Proof

was secured that this weevil (*Pissodes strobi*) is identical with the so-called *P. approximatus*, found attacking the roots of stunted white pines. Apparently the *P. approximatus* represents an infestation of the white pine weevil resulting from egg laying near the ground instead of on the leaders.

The work with the penetration of contact insecticides by O'Kane indicates that different groups of insects perform differently in the matter of penetration and toxicity, which is thought to be due to differences in the nature of the integument.

Tests were made by E. J. Rasmussen of the feasibility of determining the date of egg laying by codling moths through the use of bait traps. Between June 15 and August 15, 1,115 moths were caught in 110 traps placed in 11 orchards in 4 counties. The results thus far indicate that this method gives a rather reliable indication of the time that the eggs are deposited. The tests also indicated that the commercial product Diamalt is much superior to fermented glucose sirup for the purpose of attracting the moths.

[Work with economic insects at the Wisconsin Station] (*Wisconsin Sta. Bul. 405 (1929), pp. 117–121, figs. 2*).—In work with the grasshopper, one of the most serious insect enemies of tobacco in the State, the early use of poison bran has given satisfactory control. A method devised by C. E. Woodworth for detecting the presence of cutworms in the field consists in the scattering of cut green alfalfa over the surface after the land has been made ready for planting. Where the presence of cutworms is indicated by their having eaten the alfalfa, poison bran or alfalfa sprayed with lead arsenate is spread over the plat.

Work by W. Whitcomb and C. H. Griffith demonstrated the ineffectiveness of trap baits for the control of the onion maggot, particularly in rainy seasons. The lesser bulb fly, first observed in the State near Racine in 1915, again appeared in 1927, and in 1928 was frequently more numerous than the true onion maggot.

Continuing control work with the cabbage maggot, C. L. Fluke found the adults to lay their eggs on the oldest or largest plants available, the maturity of the plant being more of a factor than the variety of the crop. It was found that large cabbage plants set out in the field attracted more flies than young radishes or turnips, which in the past have been recommended as trap crops to attract the insects and thus protect the newly set cabbage plants. If radishes or turnips are used as a trap crop they must be planted early. Cabbage and cauliflower plants which were started in the greenhouse, and set out before the cabbage seed beds had developed leaf surface, attracted most of the flies, and nearby seed beds were well protected from maggot attack. Cabbage plants attracted as many flies as the cauliflower.

Reference is made to information gained by A. A. Granovsky of the salient factors responsible for serious outbreaks in a study of the cherry aphid which makes possible the forecasting of outbreaks.

A most unusual outbreak of the willow beetle occurred in eastern Wisconsin as far south as Madison, but more particularly around Lake Winnebago and the shores on both sides of Green Bay, the pest having appeared almost overnight on June 1. A study of the life history of the beetle by Fluke is briefly referred to.

Dusting and spraying experiments with potatoes on Long Island in 1928, H. C. Huckett (*New York State Sta. Circ. 108 (1928), pp. 12, figs. 4*).—This is a report of work conducted in continuation of that in 1926 and 1927, previously noted (E. S. R., 58, p. 756).

It was found that the use of special applications of nicotine to control aphids was not warranted by the final results, largely on account of the destruction of aphids by disease shortly after the application of such measures. Where

plants were sprayed with Bordeaux mixture the yield from nicotine-treated plats was decidedly reduced; where dusted with copper-lime mixture the yield from nicotine-treated plats was increased, except in the case of Irish Cobblers. There was little, if any, advantage to be gained by spraying with three nozzles per row instead of two. The outstanding result for the season of 1928 is said to have been the consistently good showing of Bordeaux mixture as a protection for the potato plant.

The fumigation of greenhouses to destroy insect pests, G. W. HERRICK and G. H. GRISWOLD (*New York Cornell Sta. Bul. 474 (1929), pp. 20, figs. 12*).—This is a practical account on the fumigation of greenhouses.

The bud moth, P. J. PARROTT and S. W. HARMAN (*New York State Sta. Circ. 109 (1929), pp. 10, figs. 10*).—This is a practical summary of information on the eye-spotted bud moth and means for its control.

Studies of the relative resistance to arsenical poisoning of different strains of codling-moth larvae, W. S. HOUGH (*Jour. Agr. Research [U. S.], 38 (1929), No. 4, pp. 245–256, fig. 1*).—This is a contribution from the Virginia Experiment Station reporting upon two seasons' tests in which 4,229 codling moth larvae from Virginia and 4,658 from Colorado were placed upon apples sprayed with lead arsenate and 3,310 larvae from Virginia and 2,056 from Colorado were placed on unsprayed fruit which served as checks. Experiments were also conducted with 9,062 larvae of Colorado-Virginia crosses. The Colorado larvae showed consistently a marked superiority over the Virginia larvae in the proportion that survived, also in the number of obvious side injuries produced, and similar but less marked superiority was shown on unsprayed fruit. The crosses were found to be different from either of their parents in that they were much less capable of successful penetration of sprayed fruit than Colorado larvae, but somewhat more successful than Virginia larvae.

Comparative tests with 1,461 larvae whose parents came from Yakima, Wash., indicate that Washington codling moth larvae are similar to the Colorado-Virginia crosses in their ability to enter and injure sprayed fruit. They were considerably inferior to the Colorado larvae and slightly superior to the Virginia larvae. Their superiority over Virginia larvae was demonstrated in comparative tests made both at Yakima, Wash., and at Winchester, Va. When allowed to attack apples sprayed with lead arsenate diluted at the rate of 2 lbs. of lead arsenate to 100 gal. of water, the Virginia larvae were not widely different in their performance in Washington State and Virginia.

The oriental peach moth in New York, D. M. DANIEL (*New York State Sta. Circ. 106 (1928), pp. 8, figs. 6*).—A practical summary of information on this enemy of the peach, first found in New York in a few orchards in the Lake Erie Valley near the Pennsylvania line in 1926, whence it spread along Lake Erie in Chatauqua County to Sheridan. It also appeared in several orchards along the Niagara River in 1927.

The fruit tree leaf roller in western New York, S. W. HARMAN (*New York State Sta. Circ. 111 (1929), pp. 11, figs. 6*).—This is a practical summary of information on the fruit tree leaf roller, with particular attention to control measures. The pest has been steadily increasing in importance since 1911, when it first came to attention in western New York.

Life history, habits, and control of the European corn borer in Erie and Chautauqua Counties, G. E. R. HERVEY (*New York State Sta. Circ. 107 (1928), pp. 11, figs. 4*).—This is a progress report on the European corn borer presented at the annual meeting of the Association of New York State Canners, held at Rochester, N. Y., December 13, 1928. Data showing the relation between

the life history of the corn borer, dates of planting, and the rate of infestation in Erie County are presented in tabular form.

In studies of the influence of plowing on the caterpillars, it was found in both cage and field experiments that a high percentage of caterpillars plowed under came to the surface of the soil again in a period of time varying from a few days to upwards of three or four months. This emergence of the caterpillars was well over 50 per cent in many cases. When infested stalks are plowed under in the fall a few of the borers emerge, but the majority of them remain in the stalks underground during the winter, and those which have survived come to the surface during April and May of the following spring. When the infested stalks are plowed under in the spring, the borers begin to come to the surface at once, but the emergence continues until the first week in June. It was found that fall plowing appears to be much more effective in the destruction of the borers than spring plowing, the number of live borers recovered after spring plowing being in many cases double that recovered from fall plowing. It was observed that the borers that regain the surface of the soil are capable of migrating long distances and of obtaining shelter in a variety of objects.

In an examination of a number of species of weeds occurring both in and around the margins of cornfields, those most subject to infestation were found to include redroot pigweed, ragweed, lamb's-quarters, smartweed, and beggar-ticks. The weeds examined from the margins of a number of fields in most cases contained a slight infestaton up to 10 or 15 yds. from the edge of the corn.

Some 30 materials, including both dust and spray mixtures, were tested with a view to discovering a poison that would be effective when used against the young borers immediately after hatching and before they had an opportunity to enter the corn plant. While the experiments were preliminary in nature, evidence was obtained that some of the materials tested will effect a considerable reduction in borer population, although they caused some burning of the leaves.

A survey made of the extent and injury of sweet corn in the Eden Valley, where rigid clean-up measures have been practiced, is briefly reported upon.

Cotton or weevils, J. L. Webb and F. A. Merrill (*U. S. Dept. Agr., Misc. Pub. 35 (1929), pp. II+17, figs. 10*).—This is a practical account of the cotton boll weevil and means for its control, and was prepared especially for boys and girls.

Bee investigations (*Kansas Sta. Bien. Rpt. 1927–28, pp. 108, 109*).—In a study of the collection of food by the honeybee, commenced in 1927, valuable data are said to have been obtained on the relation of nectar flow and climatic conditions as well as the identification of pollen-yielding plants. Dry substitutes for pollen such as dried skim milk and dried egg yolk when fed within the hive were not beneficial. Neither was wheat flour when gathered and taken into the hive by bees.

Several colonies were divided in the spring of 1927 to provide for an increase without at the same time reducing the output of honey below that of undivided colonies, this being possible in regions where the honey flow comes from 11 to 15 weeks after brood-rearing normally begins. It was found that colonies treated in this manner during the first two weeks of April produced as large crops as undivided ones. In this way the honey crop can be doubled. It is also said to be possible in the Plains region to requeen colonies during the early part of April without impairing the strength of the colony at the time of the honey flow.

In experimental work in the field treatment of American foulbrood, conducted during the summer of 1927, the smoke down, the smoke over, and the ...nte methods of transferring bees from diseased to disease-free bee equipment proved the best. The shaking method is not recommended unless the colonies are isolated from other bees. Treatment should be made only on warm days during a honey flow, and following the treatment queen excluders should be put in the entrance of hives. If all bees, honey, and brood in a diseased colony are burned, a thorough clean-up is said to be assured. Cerelose, when fed in a solntion of 2 parts of sugar to 1 part of water, was found to be unsatisfactory as a winter food, since it solidified in the comb and in the digestive tract.

Variation and correlation in the appendages of the honeybee, E. F. Phillips (*New York Cornell Sta. Mem. 121 (1929), pp. 52, figs. 2*).—The studies here reported in detail indicate that drones are considerably more variable than the worker bees. "The irregularity in cell size has a direct effect on variability by bringing about a lesser degree of homogeneity in the material, from which it may be concluded that the size of the cell directly affects the sizes of various parts of the body. This effect doubtless arises from the amount of food taken, although there may be some influence from pressure of the cell walls themselves, a suggestion which can not be proved from the present material. The hooks on the hind wings are erratic in variability."

Biology of the European red mite in the Pacific Northwest, E. J. Newcomer and M. A. Yothers (*U. S. Dept. Agr., Tech. Bul. 89 (1929), pp. 70, figs. 25*).—This is a report of studies of the life history, habits, seasonal history, natural enemies, etc., of the European red mite (*Paratetranychus pilosus* Can. and Fanz.).

It was found that in the Pacific Northwest there is an average incubation period of approximately 10 days, a larval period of 3.5 days, a nymphal period of 6 days, and a preoviposition period of 2.5 days, which would result in a complete life cycle of approximately 22 days. The individuals actually completing their life cycle in 1923 averaged 21.05 days, and those completing the life cycle in 1924 averaged 20.42 days. The female mites oviposit for approximately 11 days, during which time they generally deposit from 20 to 24 eggs, or about 2 eggs per day. Individual records were obtained, however, of females that deposited 80 to 90 eggs. The females live about 15.5 days and the males about 11.5 days on the average, although some individuals have been found to live as long as 39 and 34 days, respectively.

This mite, first noted in North America in 1911, now found throughout the eastern part, north of latitude 37° N. and west to Indiana, and also very common in the Pacific Northwest, occurring as far east as Utah and south to central California, has become an important fruit-tree pest, attacking most of the deciduous trees.

No true parasites of the mites have been observed, but predacious enemies play an important part in their control. Chief among these in the Pacific Northwest is a coccinellid, *Stethorus picipes* Casey; a thrips, *Scolothrips sexmaculatus* Perg.; an anthocorid, *Triphleps insidiosus* Say; and a gamasid mite, *Seius* sp.

A list of 32 references to the literature is included.

ANIMAL PRODUCTION

Advantages of standards for livestock and meats, C. E. Gibbons (*U. S. Dept. Agr. Misc. Pub. 33 (1929), pp. II+14*).—The author discusses the need for standards in marketing livestock and meat and the basis for the present

standards. The advantages of the use of the standards from the standpoint of the producer, markets, market reporter, packer, retailer, and consumer are pointed out.

Commercial feeding stuffs, September 1, 1927, to August 31, 1928, F. D. FULLER (*Texas Sta. Bul. 392 (1928), pp. 188*).—This is the twenty-third report of the chemical analyses and microscopical examination of 2,624 feeding stuff samples collected for official inspection during the year ended August 31, 1928 (E. S. R., 58, p. 865).

Brief history of cattle breeding in Alaska, C. C. GEORGESON (*Alaska Stas. Bul. 8 (1929), pp. 23, figs. 20*).—A brief history of the introduction of cattle into Alaska by the Russians previous to 1867 and the introduction of the Galloway, Holstein, Milking Shorthorn, and yak breeds are noted in this publication. Preliminary results of studies in crossing Galloways with Holsteins and yaks to produce useful and hardy types of cattle are reported.

Beef cattle experiments (*Georgia Sta. Rpt. 1928, pp. 20–22*).—A group of 15 cattle that had received uniform treatment for a year previous to the start of the test was used in this study. Three animals were killed following grazing and used as checks. The remaining animals were divided into 3 equal lots and fed either shelled corn, velvetbeans (in the pod), or shelled peanuts ("pick-out" grade from confectionery) with clover hay for 139 days. At the end of this feeding period they were slaughtered and samples of kidney fat taken for determination of melting point and refractive index number of the fat. The analyses showed that the average melting point for the check lot was 52.73° C., for the corn lot 47.7°, for the velvetbean lot 50.35°, and for the peanut lot 56.87°. The refractive index for the respective groups at 60° was 1.4484, 1.4491, 1.4485, and 1.4482.

[Experiments with beef cattle at the Kansas Station] (*Kansas Sta. Bien. Rpt. 1927–28, pp. 84, 85, 87*).—The results of two experiments are noted.

Methods of utilizing native pasture in beef cattle feeding.—Calves wintered on silage, cottonseed meal, and alfalfa hay without grain gained 209.4 lbs. per head in 135 days as compared with 281.87 lbs. per head for similar calves fed an average of 4.66 lbs. of corn per day in addition to the above ration. On grass from May 1 to August 1, the calves fed no grain gained 113.5 lbs. per head as compared with 76.3 lbs. for those that had received a limited grain ration. In dry lot from August 1 to November 7, the first lot of calves ate more corn and gained 28.5 lbs. more per head than the second lot. At the end of the feeding period both lots of cattle sold for the same price, but the necessary selling price to break even was 44 cts. per hundredweight less for the calves wintered with no grain.

Calves wintered on ground cane fodder ad libitum and 1 lb. of cottonseed meal per day gained 1.31 lbs. per head daily, while a second lot receiving cane silage ad libitum and 1 lb. of cottonseed meal gained 1.3 lbs. per head daily. On pasture for 160 days the silage-fed calves gained 1.25 lbs. and the fodder-fed calves 1.2 lbs. per head daily. The calves fed cane fodder returned approximately 50 cts. more per head for the grass consumed than did those wintered on cane silage. This phase of the study indicates the possibilities of substituting yearlings for aged steers on Kansas pastures, particularly in those cases where calves can be purchased in the fall and wintered on feed crops grown on the farm.

A study of pasture values and pasture methods for horses, cattle, sheep, and swine.—Continuing these studies (E. S. R., 56, p. 864) it was found that for early growth, second-year sweetclover required considerable warmth. Bromegrass produced more pasture per unit of area on upland but less on bottom land than orchard grass. When planted in the fall bromegrass made a better early growth

and a more vigorous growth during the dry weather of the following spring than did orchard grass. Sudan grass again proved to be the best of all the mid-summer pastures.

Cattle feeding investigations, 1926–27, B. M. ANDERSON, C. W. MCCAMPBELL, and H. W. MARSTON (*Kansas Sta. Circ. 143 (1928), pp. 13, fig. 1*).—The results of a study of winter fattening of calves and of winter feeding and summer fattening of calves and yearlings are reported.

Silage and alfalfa hay v. silage, prairie hay, and minerals as the roughage portion of a calf-fattening ration fed during the winter in a dry lot.—In a comparison of alfalfa and prairie hay 6 lots of calves averaging approximately 355 lbs. per head were selected for a 175-day experiment. All lots received shelled corn, cane silage, and cottonseed meal. Lot 1 received alfalfa hay and the other lots priarie hay. In addition lot 3 received 0.1 lb. of ground limestone per head per day, lot 4 0.1 lb. of superphosphate, lot 5 0.05 lb. each of ground limestone and superphosphate, and lot 6 0.1 lb. of bone meal.

The average daily gains in the respective lots were 2.5, 2.17, 2.46, 2.19, 2.36, and 2.32 lbs. per head. The cost of gains was higher and the selling price and profit per head lower in lot 2 than in lot 1. Lot 3 made more economical gains and sold for a higher price than lot 2 but returned a smaller margin per hundredweight than lot 1. Lot 4 returned less profit than lot 2, while lot 6 was but little more profitable than lot 2. The calves in lot 5 returned more profit than in lot 4, but this ration was not as profitable as that used in lot 3.

These results indicate that the addition of a small amount of ground limestone to a ration containing prairie hay makes this roughage almost equal to alfalfa hay. Ground limestone also proved to be more valuable than superphosphate or bone meal as a calcium-bearing supplement to prairie hay.

Calves v. yearlings for wintering well, grazing without grain until August 1, then full feeding on pasture or in a dry lot for 100 days.—In this study 2 lots of 10 yearlings each averaging approximately 622 lbs. per head, and 2 lots of calves with 10 in 1 lot and 9 in the other and averaging approximately 464 lbs. per head were fed from January 1 to May 11 on a ration limited to approximately 5 lbs. of corn, 1 lb. of cottonseed meal, and 2 lbs. of alfalfa hay per day, and all the cane silage they would consume. During this phase of the study the average daily gains in the respective lots were 1.77, 1.89, 1.47, and 1.45 lbs. per head.

From May 11 to August 1 all lots were grazed on bluestem without any supplementary feed. During this period the average daily gains were 0.67, 0.68, 1.08, and 1.03 lbs. per head in the respective lots. At the end of this period the necessary selling price to break even was only 35 cts. per hundredweight in favor of the yearlings, lots 1 and 2, where it had been 83 cts. per hundredwight in favor of the same lots at the end of the wintering period.

On August 1 lots 1 and 3 were placed in dry lot and lots 2 and 4 continued on pasture. Each lot was fed 1 lb. of cottonseed meal and all the ground corn they would eat per head per day until November 8. In addition the dry lot cattle received all the alfalfa hay they would consume. The average daily gains during this period were 2.4, 2.07, 3.01, and 2.38 lbs. per head in the respective lots. The necessary selling price to break even was 18 cts. per hundredweight in favor of lot 3 in comparing dry lot feeding and 33 cts. per hundredweight in favor of lot 2 in comparing pasture feeding at the end of this phase of the study.

This system of handling cattle, either calves or yearlings, proved to be a satisfactory and profitable method, but it is pointed out that a heavy feed of grain is necessary during the full feeding period to put the animals in the proper condition to sell well.

The influence of feed on the color, chemical composition, and cooking quality of the meat of grass-fat cattle (*Kansas Sta. Bien. Rpt. 1927–28, pp. 87–89*).—In this study 18 3- and 4-year-old Texas steers grazed during the summer on Kansas pastures were divided into 3 lots of 6 head each. One lot was killed the first of August, a second lot was left on pasture for additional 28 days, and a third for 56 additional days. After slaughter the carcasses were cooled for 24 hours at from 32 to 34° F. and then cut into eight wholesale cuts. For color readings the meat samples were taken 5 days after slaughter, and the readings made immediately after cutting, 30 minutes later, 3 hours later, and 24 hours later.

The cuts brightened materially after cutting, especially during the first 30 minutes, but after about 3 hours there was a tendency toward darkening. There was a tendency for the meat of the better finished cattle to be darker in color at the time of cutting. These observations indicate that discrimination against grass-fat cattle on the basis of color of beef alone is not warranted. In this work the quality of the cattle appeared to have more influence on the color of the beef than did the feed.

Chemical analyses were made of rib, round, and cross-arm samples, which showed an average moisture content of 71.8, 73.9, and 75 per cent and an average ash content of 1, 1.2, and 1.1 per cent, respectively. The protein content of the rounds and cross arms was 21.2 and 20.4 per cent, respectively. The moisture content of the fat of the rib samples varied from 37 to 18.2 per cent, and the melting point of the purified fat from 37.4 to 45° C., while the iodine number varied inversely with the melting point.

Fattening steers of various ages, H. J. Gramlich (*Nebraska Sta. Bul. 229 (1928), pp. 57, figs. 10*).—This publication sums up the results of 4 trials (E. S. R., 54, p. 360), in which a comparison was made of the rate and economy of gains of 3-year-old, 2-year-old, and yearling steers and steer calves on a ration of shelled corn and alfalfa hay for a period of 200 days.

The calves made more economical gains than any of the other classes of cattle. The 2- and 3-year-olds made more rapid gains during the first 100 days than did the yearlings and calves, but during the second half of the feeding period the calves gained more rapidly than older cattle. Calves made as much gain from 61.2 lbs. of feed as yearlings did from 82.2 lbs., 2-year-olds from 94.2 lbs., and 3-year-olds from 100 lbs. For each bushel of corn and 19.6 lbs. of alfalfa hay calves gained 10.6 lbs.; with the same amount of corn and 22 lbs. of hay yearlings gained 8 lbs.; for each bushel of corn and 22 lbs. of hay 2-year-olds gained 6.9 lbs.; and for each bushel of corn and 23.3 lbs. of hay 3-year-olds gained 6.7 lbs. Beginning with the calves it required 529, 702, 798, and 836 lbs. of corn, respectively, to produce 100 lbs. of gain, and the hay necessary to produce this gain increased in like proportion. The 3-year-old cattle required less time for finishing than the younger classes of animals. The calves were worth more as feeders than as killers at the end of the first half of the feeding period. Calves required less spread between buying and selling price in order to break even than other classes of cattle.

[Experiments with beef cattle at the Wisconsin Station] (*Wisconsin Sta. Bul. 405 (1929), pp. 55, 57–62, figs. 2*).—The results of 3 experiments, all of which have been continued (E. S. R., 59, p. 66), are reported.

Chopping alfalfa hay saves concentrates for beef cows.—The results of a 3-year study by J. G. Fuller and B. H. Roche show that cows fed chopped alfalfa hay gained an average of 0.35 lb. per head daily for each 17-week period, while similar cows fed long hay and 10 per cent more grain gained 0.21 lb. per head daily. In 2 of the 3 tests, the calves running with their dams on the chopped hay ration made better average gains than calves in the long-hay lot.

Linseed and cottonseed meal for fattening steers.—Concluding this study by Fuller and Roche, the results for the 3 years are found quite comparable. The average daily gains were practically the same in the third test, but due to the fact that 2 steers in the lot fed a mixture of linseed meal and cottonseed meal lacked finish and smoothness, this lot sold for 50 cts. per hundredweight less than the linseed meal lot. Based on the 3 years' results, the authors conclude that when cottonseed meal is as much as $8 per ton lower in price than linseed meal, it is economical to replace one-half the linseed meal supplement with cottonseed meal for fattening young cattle.

Baby beef from crossbred Angus-Holstein calves.—This study has been continued under practically the same conditions and almost identical results obtained. At the end of the feeding period the animals were sold for slaughter and the carcasses graded. Of the steers in the Angus-Holstein group, 4 carcasses graded choice and 4 good; in the Holstein group there were 7 medium carcasses and 1 fair carcass; and in the Angus group 3 prime, 3 choice, and 2 good carcasses. There was little difference in the wholesale cuts of the crossbred and Angus carcasses, but in certain places the latter showed slightly better shape and marbling. The noticeable faults of the Holstein cuts appeared in the chuck, which was flat and not as well muscled as the others, and in the thinner covering of fat on the ribs. No criticism was made of the color in any of the carcasses.

Lamb feeding investigations (*Kansas Sta. Bien. Rpt. 1927–28, p. 86*).—The addition of 0.25 oz. of ground limestone to a ration of shelled corn, oats, bran, linseed meal, cane silage, and alfalfa hay did not increase the rate of gain nor the average weight of fleece of native lambs fed for 150 days.

Swine feeding and quality of pork, F. R. Edwards (*Georgia Sta. Circ. 84 (1929), pp. 12*).—The results of studies in feeding swine and on quality of pork are reported in this circular.

Part 1 is a study of the value of velvetbeans for swine. Five lots of 10 pigs each were fed as follows: Lot 1 shelled corn, tankage, and mineral mixture; lot 2 50 per cent corn and 50 per cent ground shelled velvetbeans, tankage, and mineral mixture; lot 3 shelled velvetbeans, tankage, and mineral mixture; lot 4 shelled velvetbeans and mineral mixture; and lot 5 cooked shelled velvetbeans and mineral mixture. All lots were self-fed free choice. The average daily gain per pig was highest in lot 1, followed in order by lots 2, 5, 3, and 4. The cost per unit of gain was lowest in lots 1 and 5 and highest in lot 3. The average grading for fat hardness in the respective lots was hard, medium hard, medium soft, medium soft, and medium hard.

In a comparison of fish meal and tankage as protein supplements 2 lots of 12 pigs each were fed for 85 days on corn and mineral mixture and one of the protein supplements. Lot 1 fed tankage gained 149.6 lbs. per head during the test and lot 2 fed fish meal gained 167.7 lbs. Lot 1 consumed less corn and slightly more protein supplement and minerals than lot 2. All carcasses graded hard, and the refractive index of leaf fat samples at 40° C. showed no significant differences.

In part 2 samples of pork, including hams, bacons, shoulders, chops, sausage, and lard, were obtained from pigs fed to produce soft pork and graded in both uncooked and cooked conditions (E. S. R., 59, p. 261). Uncooked meats graded consistently higher with increasing hardness. The cooked samples showed an increase in desirability and palatability for a 56-day period on hardening feed, but a longer hardening period failed to show any increase in quality, the data indicating that the longer period lowered the palatability of the cooked meat. These results were true with soft peanut, soft velvetbeans, and

soft chufa fed pork. The results indicate that while soft pork is not as attractive as firm pork before cooking it is about as good a product as firm pork after cooking.

A comparison of the appearance and aroma of uncooked meat and of the appearance, aroma, and flavor of cooked meat cured with smoked salt using the brine cure and dry salt curing methods showed the latter to have a very slight advantage. However, when the amount of equipment needed and the possibility of spoilage are considered the dry salt method is deemed most desirable for farm conditions. Meat cured in the regular sugar brine followed by smoking with hickory smoke was judged slightly superior to meat cured by the smoked salt method in the uncooked state, but the reverse was true after the meat had been cooked.

Boston butts from hogs fed corn and fish meal and corn and tankage for 85 days were cooked for 1.75 hours at 600° F. and then judged. None of the 15 judges detected a fishy flavor or odor in the meat from the fish meal fed pigs. This led to the conclusion that fish meal does not affect the flavor or odor of pork.

Swine feeding investigations (*Kansas Sta. Bien. Rpt. 1927–28, pp. 85, 86*).—Cottonseed meal was found to be less satisfactory than tankage as a protein supplement to corn and alfalfa pasture in producing gains and finish, while the addition of ground limestone or bone meal did not materially increase the value of cottonseed meal. A combination of the two was very satisfactory and reduced the cost of gains. For winter feeding in dry lot cottonseed meal was decidedly inferior to tankage. Adding bone meal during dry lot feeding materially increased the value of cottonseed meal, while the addition of ground limestone had practically no beneficial effect. Cottonseed meal was found to be more efficient as a protein supplement to alfalfa pasture than to alfalfa hay.

[**Irrigated pastures at the Garden City, Kans., Substation**] (*Kansas Sta. Bien. Rpt. 1927–28, p. 136*).—Continuing this study (E. S. R., 56, p. 865), the average daily gain over a 5-year period of pigs full fed milo on irrigated alfalfa pasture was 1.29 lbs. It required 395.72 lbs. of feed to produce 100 lbs. of gain, and the gross return per acre above feed cost was $105.42, equivalent to $17.57 per ton for the alfalfa. Pigs on a limited ration of milo gained at the rate of 0.55 lb. per head daily, required 293.11 lbs. of feed for each 100 lbs. of gain, and had a gross return above feed cost of $72.05 per acre, equivalent to $12.01 per ton for the alfalfa.

Comparative tests of certain feeds in rations for pigs, E. A. Livesay and E. C. Stillwell (*West Virginia Sta. Bul. 213 (1928), pp. 16, figs. 4*).—A comparison of white and yellow corn for fattening hogs was the principal object of 3 studies with pigs averaging 70 lbs. each in 2 and 80 lbs. each in the other study. Supplementary to the main problem was a study of the value of buckwheat middlings, a comparison of tankage and fish meal, and the value of fermenting carbohydrate feeds with yeast. The experimental lots consisted of 10 head each. The feed mixture used was made up of 300 lbs. of either white or yellow corn, 100 lbs. of wheat middlings or buckwheat middlings, and 20 lbs. of tankage or fish meal. When fermented feed was used 1 lb. of yeast was mixed with 100 lbs. of corn and middlings covered with water and allowed to ferment for from 36 to 48 hours before feeding. In one test minerals were also fed. The trials were of 98, 84, and 70 days duration, respectively.

The results obtained indicated that yellow corn is superior to white corn for pigs of this weight, although the pigs on white corn made as economical

gains as those on yellow corn for a period of about 70 days. In 2 of the 3 trials pigs on white corn developed a rachitic condition which the data indicated was due to a lack of the antirachitic factor rather than to a lack of the fat soluble vitamin. Buckwheat middlings produced more rapid and economical gains than standard wheat middlings, but since the composition is variable an analysis of the product should be made before feeding. Fish meal and tankage proved to be approximately equal in feeding value. Buckwheat middlings, fish meal, or minerals failed to prevent rickets in the white corn fed lots. Fermenting the feed failed to increase the rate or economy of gains, but did give a sleek appearance to the hair coat.

[Experiments with swine at the Wisconsin Station] (*Wisconsin Sta. Bul. 405 (1929), pp. 51–53, 54, 63, 64, fig. 1*).—The results of experiments, mostly continuations of those previously noted (E. S. R., 59, p. 67), are reported.

Pigs and pregnant gilts on good rations do not need mineral feed.—Studies carried on by F. B. Morrison and J. M. Fargo over a period of 7 years and involving 26 lots of 10 pigs each showed that adding minerals to a ration containing tankage and pasturage or alfalfa hay only increased the cost of the ration. When measured by the number and strength of the pigs farrowed, minerals for pregnant gilts under similar conditions failed to add anything to the ration. In one lot receiving floats, the sows farrowed twice as many weak pigs as a check lot. On the other hand, a mineral mixture of bone meal and potassium iodide reduced by half the number of weak pigs farrowed when tankage was not fed. Minerals are desirable for pigs confined in dry lots and without access to pasture or alfalfa hay.

Sunlight and alfalfa hay good for brood sow and litter.—G. Bohstedt, W. M. Insko, jr., and Fargo found that pigs whose dams were confined indoors and received no alfalfa hay during the suckling period responded more readily to irradiation than pigs whose dams received 10 per cent of alfalfa hay. While there was no great difference in the growth of irradiated and nonirradiated pigs, it was found that the ash content of the bones and the inorganic phosphorus content of the blood serum were higher in the irradiated pigs.

[*Oat feed for pigs*].—At the Monona Farm 3 experiments were conducted to determine the value of oat feed, using 2 lots of 10 pigs each of an average initial weight of 71, 58, and 46 lbs., respectively. The ration for the check lot consisted of hominy feed, tankage, linseed meal, and alfalfa meal and contained 6 per cent of fiber. Approximately 10 per cent of oat feed replaced a like amount of hominy feed in the ration fed the second lot in each test, increasing the fiber content to 8 per cent. The rates of gain of the check lots as compared with the oat-fed lots were as follows: 1.49 to 1.52, 1.29 to 1.32, and 1.21 to 1.21 lbs., respectively.

Birth weight important factor in swine production.—A. H. Kuhlman and L. J. Cole have found that up to a birth weight of 2.8 lbs. the percentage of pigs raised increases, but heavier birth weights had no advantage. Only 75 per cent of the pigs farrowed survived the first 4 days, and 37 per cent were lost during a 56-day suckling period. The average birth weight of 972 pigs farrowed by yearling sows was 2.35 lbs. and of 1,344 pigs farrowed by aged sows 2.55 lbs. At the end of the suckling period 207 pigs from yearling sows averaged 23.02 lbs. and 227 pigs from aged sows averaged 27.1 lbs., and the difference in weight at 98 days of age was 9.38 lbs. in favor of the pigs from aged sows. The results of this study indicate that pigs of a low birth weight are apt to be an economic loss, and that in general aged sows produce larger and more uniform litters and take better care of their pigs than yearling sows.

Chopping hay for horses does not pay (*Wisconsin Sta. Bul. 405 (1929), p. 55*).—In completing a third trial (E. S. R., 59, p. 70), J. G. Fuller and B. H.

Roche fed 1 horse in each of 8 teams chopped timothy hay, while its team mate received long hay. The grain ration of the horses fed chopped hay was reduced 10 per cent. After 8 weeks feeding the rations of the team mates were reversed. The average gain of each horse on long hay was 13.8 lbs., and the average loss for each horse on chopped hay was 38.6 lbs. It was found that with average farm machinery the cost of chopping timothy hay was 79.8 cts. per ton.

[Experiments with poultry at the Kansas Station] (*Kansas Sta. Bien. Rpt. 1927–28, pp. 102–106*).—The results of three experiments in continuation of those previously noted (E. S. R., 56, p. 867) are reported.

A study of the use of hydrolyzed feathers as a feed for chickens.—Hens fed hydrolized feathers as a portion of the protein supplement had a slightly higher egg production during the first year and a lower production for the second year of the study than the check lot. The feather feeding delayed molting about two weeks, but there was no difference in the feed consumption or body weights of the two lots. Broilers fed the feather feed made poorer gains than the check lot, and in one test the feather-fed lot showed less cannibalism, while in the second test no differences were observed. Baby chicks receiving feather feed as a sole source of animal protein made poorer gains than the check lot, while another lot receiving half their animal protein from feather feed made slightly less gains than the check lot. These results led to the conclusion that hydrolyzed feathers are no more valuable than other protein supplements and that the cost of hydrolyzation is too great for this feed to compete with other protein supplements.

The effect of an inadequate ration on the production and hatchability of eggs.—In this study it was found that rations deficient in vitamin A decreased the average egg production, had no effect on the percentage of fertile eggs, decreased the percentage of fertile eggs hatched, and increased markedly the mortality.

The relation of the vitamin content of the feed to immunity to roup.—Continuing this study it was again found that hens on a vitamin A-deficient diet developed eye, nose, and throat infection, while none of those receiving vitamin A developed these disorders. No increase in the uric acid content of the blood of hens on a diet deficient in vitamin A was observed until an advanced stage of the disease. At this time the comb darkens, the eyes water and fill with a white cheesy-like material, the tissue around the eyes become edematous, and the ureter becomes congested with urates to such an extent as to stop the flow of urine. No feed or water is taken during this time. Forced feeding or giving water by means of a pipette did not prevent the increase of uric acid in the blood nor the formation of urate crystals, and the water increased the edematic condition of the eyes. Fasting of normal hens increased the uric acid content of their blood, and feeding cod-liver oil to these hens had no effect on the uric acid condition of the blood.

[Poultry experiments at the Wisconsin Station] (*Wisconsin Sta. Bul. 405 (1929), pp. 41–46, fig. 1*).—Several experiments are reported in continuation of those previously noted (E. S. R., 59, p. 70).

Is orange pulp a good source of vitamins A and D in poultry nutrition?—A commercial dried orange pulp for which claims of potency in vitamins A and D were made was fed to chicks by E. B. Hart, H. T. Scott, and J. G. Halpin. Even when fed at a 10 per cent level, there was not sufficient vitamin A present to protect against vitamin A deficiencies. The ash content of the leg bones never exceeded 37 per cent, while the content for normal birds at the same age ranged from 45 to 48 per cent of ash.

Glass substitutes prove valuable in baby chick trials.—In determining the ability of glass substitutes to transmit the antirachitic factor of winter sunlight, Hart, Scott, Halpin, and O. N. Johnson found that chicks kept behind ordinary window glass during the period from November 28 to January 9 showed unmistakable symptoms of leg weakness, and their leg bones contained only 33 to 37 per cent of ash. Chicks behind Corning glass had an ash content of 45 to 49 per cent, behind Vitaglass approximately the same, behind Cel-O-Glass 46 to 48 per cent, behind Flax-O-Glass 41 to 45 per cent, and with direct sunlight 42 to 46 per cent. No cases of leg weakness developed in any of the lots behind glass substitutes.

Open poultry house windows effective as cod-liver oil in promoting winter egg production.—Hart, Halpin, and Johnson found that the egg production of 8 lots of 35 pullets each for the period October 1 to April 30 was again high in the lots in which the birds were exposed to direct sunlight or irradiated daily with ultra-violet light or the ration supplemented with cod-liver oil. The supplements of light or cod-liver oil did not produce a higher hatchability than where birds were in direct sunlight throughout the winter.

Soft shelled eggs and vitamin D.—About 28 to 40 per cent of the eggs laid by birds kept behind closed glass windows with no irradiation were cracked or broken during marketing, while only 2 per cent were defective in lots that were irradiated or exposed to direct sunlight.

No ill effects follow early feeding of baby chicks.—In determining the effect of early feeding upon chicks, C. E. Holmes, Halpin, and B. A. Beach used 3 lots of 50 chicks each taken from the incubator before they were dry. One lot was not fed nor allowed to drink until 72 hours old. A second was handled in the same manner until 48 hours old, while the third was given feed and drink immediately. The same ration was fed to all chicks. Chicks that died were examined and the yolk sacs weighed, and 6 chicks from each lot were killed and examined at the end of 1, 2, and 3 weeks. The test ended at 6 weeks when all chicks were killed and their yolk sacs weighed.

At the end of 3 weeks the average weight per chick was 119.5, 142.7, 143.5 gm. in the respective lots. During the test 5 chicks in lots 1 and 2 and 2 in lot 3 died. At the end of the first week the average weight of the yolk sacs was 2.64, 0.96, and 0.4 gm. in the respective lots, and at the end of 6 weeks 3 unabsorbed yolk sacs were found in the 27 chicks in each of lots 1 and 2 and 2 among the 30 chicks in lot 3.

A study of certain normal characteristics of White Leghorn females (*West Virginia Sta. Bul. 220 (1928), pp. 16, figs. 3*).—The records of 188 White Leghorns during their first laying year are analyzed in this publication. Each egg was weighed individually and each bird monthly during the test.

The average weight of the birds ranged from a minimum of 2.84 lbs. to a maximum of 4.37 lbs., with a mean weight of 2.62 lbs. at the start and 3.76 lbs. at the end of the year. The minimum egg production was 15 eggs and the maximum 255, with an average for the year of 168.52 eggs. Two hundred or more eggs were laid by 45 of the birds, while only 8 laid less than 100 eggs each. The average weight of eggs ranged from a minimum of 44.9 gm. to a maximum of 61.9 gm., with a mean weight of all eggs during the year of 53.09 gm. During the test 47 pullets laid a total weight of 10,000 gm. or more of eggs. The average size of the eggs increased from the beginning to the close of the year with but few exceptions.

It was found that the heavier birds laid the heavier eggs, but no relationship existed between the size of the eggs and the number laid per bird or between the number of eggs laid and the size of the bird. Early-maturing pullets laid

more eggs during the year than the slower-maturing birds, but no relationship existed between the age at sexual maturity and the average size of the bird. There was a rather close correlation between the increase in the mean weight of the eggs and the increase in the weight of the bird.

Do slow feathering birds grow faster? (*New Hampshire Sta. Bul. 238 (1929), p. 26, fig. 1*).—In this study by E. M. Gildow 462 rapid-feathering chicks averaging 0.2034 lb. each at 15 days of age and 554 slow-feathering chicks averaging 0.2003 lb. each were compared as to rate of growth. Rapid-feathering pullets and slow-feathering cockerels were most numerous in the respective lots. At 65 days of age the rapid-feathering pullets weighed on the average 0.36 lb. more and the rapid-feathering cockerels 0.2 lb. less than the slow-feathering individuals.

The distribution of egg production, O. S. WILLHAM (*[Oklahoma] Panhandle Sta., Panhandle Bul. 4 (1929), pp. 14–19, fig. 1*).—The percentage production of the 12 pens of Leghorns at the second Panhandle Agricultural College egg-laying contest, a comparison of high and low producing hens, and a comparison of percentage production for high, low, and average hens are given in this article.

DAIRY FARMING—DAIRYING

[Experiments with dairy cattle at the Kansas Station] (*Kansas Sta. Bien. Rpt. 1927–28, pp. 89–96, 132*).—The results of experiments in continuation of those previously noted (E. S. R., 56, p. 870) are reported.

Factors influencing the mineral metabolism of dairy cows.—A comparison of the vitamins C and D content of the milk of 2 cows kept in the barn out of direct sunshine and with no fresh green feed and of 2 cows on pasture during the spring and summer was made, using guinea pigs, chickens, and rats as laboratory animals. No difference was found in the vitamin C content of the milk from the 2 lots, but the vitamin D content was much higher in the milk from the cows in the second lot.

The vitamin C content of fine quality silage was practically nil as determined with guinea pigs, and there was no difference in the vitamin C content of milk from silage and nonsilage fed cows.

A group of 4 calves were placed on a milk diet and all had access to water which contained some iron. Two of the calves had iron citrate added to their milk each day. The animals were muzzled and allowed to run in the yard. After 9 months' feeding all the animals were below normal in weight and height and the original supposedly sufficient supply of milk was increased 20 per cent, and after 10 months' feeding 40 per cent. One calf died of spasms after 10 months' feeding. A second became weak and out of condition, and in spite of efforts to save it by feeding grain and hay died at 13 months. The other 2 calves became extremely nervous, but the condition was relieved by feeding wheat-germ stock. One of these calves developed a severe case of anemia after 1 year's feeding, which was relieved by feeding liver.

The average length of life of a rabbit fed milk alone was 3 to 4 months, while the addition of iron salt plus the ash of lettuce, cabbage, or alfalfa seemed to promote normal growth.

Dairy cattle feeding investigations.—A total of 23 cows were fed through three 30-day periods, using the reversal system to compare ground soybeans and linseed meal for milk production. The cows receiving linseed meal consumed more feed, especially grain, and were slightly heavier in body weight, but produced 0.51 per cent less milk and 1.2 per cent less fat than those receiving ground soybeans. The difference in production is probably not significant.

White sweetclover of fair quality was compared with alfalfa hay using 11 cows fed through three 30-day periods using the reversal method. Little difference in body weight was observed, but the cows receiving sweetclover ate somewhat less hay and more grain than those receiving alfalfa hay. The alfalfa hay-fed cows produced 2.7 per cent more milk and 3.4 per cent more fat than those fed sweetclover.

The percentage of butterfat was determined in samples of milk taken at each milking from 18 cows fed for alternate periods of 10 days duration on the same ration except that 5 parts of ground Kansas Orange sorgo seed replaced a like amount of corn chop at alternating periods. The difference in each of the three trials was 0.05, 0.03, and 0.02 per cent, which indicates that these two feeds make little or no difference in butterfat production.

Growing heifers fed a ration of alfalfa hay and kafir, sorgo grain, or corn for 10 months were 92.4, 85.9, and 90.2 per cent of normal weight, despite the fact that for the last 4 months of the feeding period bran replaced one-half of the grain. For 2 months after the end of this feeding test the heifers were fed according to appetite on alfalfa hay, silage, a grain mixture, and some pasture, to which they responded with an average daily gain of 1.9 lbs. per head.

Heifers that had been reared to 6 months of age on a ration containing 50 per cent of either kafir or sorgo seed were continued to first calving on that ration. Linseed meal was added to the ration of the 4 heifers in each group just previous to calving, and after one complete lactation the grain ration was reversed. Although the heifers appeared to be thrifty they were 80.8 per cent of normal weight in the kafir lot and 87.1 per cent of normal weight in the sorgo lot.

A group of 8 heifers wintered for 180 days on cottonseed meal and sorgo silage gained at the rate of 1.44 lbs. per head daily, while a similar lot wintered on alfalfa hay and silage gained 1.13 lbs. per head per day. While the breeding efficiency was low in both lots, there was no significant difference in this factor, lot 1 being bred an average of 4.3 times and lot 2 3.5 times.

A comparison of Atlas and Kansas Orange silage for milk production was made with 7 cows fed through three 30-day periods using the reversal method. There was little variation in the body weights on the two silages, but the cows ate 7.5 per cent more grain on the Kansas Orange silage ration and slightly less hay and silage. The Atlas silage produced 2.1 per cent less milk and 6.75 per cent less butterfat than the Kansas Orange silage.

Two groups of 4 cows each were fed by the double reversal method through three 30-day periods to compare soybean and alfalfa hay. The alfalfa hay was slightly better for milk production and negligibly so for fat production. The data indicated that less digestible crude protein and total digestible nutrients per unit of production were required with soybean hay than with alfalfa hay.

In a comparison of stack-browned and green alfalfa hay, 2 groups of 4 cows each were fed through two 30-day periods, using the reversal method. Little or no difference was noted in body weights on the two hays, but milk and butterfat production was greatest on the green hay. Some difficulties were experienced in getting cows to eat the brown hay at first, but later they appeared to relish it. Chemical analysis showed the brown hay to be higher in crude protein than green hay, but practically the same in true protein.

Kafir v. sorgo for dairy calves.—On a ration of milk, alfalfa hay, and sorgo silage 8 calves averaged 88.5 per cent of normal weight and 98.7 per cent of normal height, while those receiving kafir silage in place of sorgo silage averaged 89.4 per cent of normal weight and 99.2 per cent of normal height.

Silage investigations.—Samples of well-matured Kansas Orange sorgo cut for silage were placed in cans and buried in the silo, from which they were removed a month or two later and analyzed. There was an average loss of 1 per cent in total weight from the time of siloing. The protein, ether extract, crude fiber, ash, and nitrogen-free extract contents for the green sorgo and the silage were essentially the same. There was little difference in the starch content before and after siloing, but the sucrose as well as most of the reducing sugars had practically disappeared. About 2 per cent of the total carbohydrates were lost.

A study of the use of fly repellents for dairy cattle.—Various commercial fly sprays have in practically all cases reduced somewhat the number of flies on the cows at a cost varying from 1.5 to 2.5 cts. per cow per day. An average of 3 years results with 48 cows using 5 different sprays showed an increase of less than 0.1 per cent in milk production of sprayed cows over unsprayed cows. Negative results were obtained with fly salt even when fed at the rate of 6 per cent of the grain ration. The flavor was not affected by this salt.

A study of the cost of milk production.—During the years 1926 and 1927 it was found that it required on the average 9.7 lbs. of grain, 20.6 lbs. of alfalfa hay, and 38 lbs. of silage or its equivalent to produce 1 lb. of butterfat. The proportions of feed eaten varied but little with Holsteins and Jerseys or Guernseys.

Dairy cattle pasturing investigations.—At the Fort Hays Substation sweetclover has been found to be especially valuable for early pasture. For a 2-year period it has provided pasture from about the middle of May to the last of June. About the time sweetclover was exhausted Sudan grass was available and in favorable seasons grew vigorously, permitting heavy pasturing and in addition producing some hay. In 1927 15.2 acres of Sudan grass pastured the equivalent of 14 cows for 97 days and also cut 0.55 ton of hay per acre. Both types of pasture were very good for maintaining milk flow.

[Experiments with dairy cattle at the Wisconsin Station] (*Wisconsin Sta. Bul. 405 (1929), pp. 36, 37, 50, 54, 56, 57*).—Results of some experiments are reported, several of which are in continuation of those previously noted (E. S. R., 59, p. 73).

Cows fail to utilize vitamins in cod-liver oil.—A ration of corn silage, alfalfa hay, and a grain allowance rich in phosphorus and lime plus 0.5 lb. of cod-liver oil per head per day was fed to cows producing 40 to 50 lbs. of milk daily for a period of a year by E. B. Hart, H. Steenbock, G. C. Humphrey, and G. Bohstedt without any marked improvement in the lime assimilation of the animals. No disturbance in appetite due to the cod-liver oil was noted. Tests with chicks showed that the antirachitic vitamin was being expelled in the feces.

[Vitamin D content of alfalfa hay].—An average loss of lime per cow per week of 123 gm. was found with cows fed alfalfa hay cured in high altitudes in Colorado with not over 3 hours' exposure to the sun. Similar hay cured for several days in the sun reduced the loss of lime to 37 gm. per cow per week. Alfalfa cured at Madison with 3 days' exposure to the sun gave an average lime loss per week of 41 gm. per cow. These results were checked by experiments with rats.

Cod-liver oil fails to improve a good dairy calf ration.—A well-balanced grain mixture, either alfalfa or clover hay, and skim milk were fed to 2 lots of 4 calves each by W. M. Insko, jr., and I. W. Rupel. Lot 1 received 2 per cent of cod-liver oil in addition to the basal ration, while lot 2 received no additions. Blood samples taken at intervals during the feeding period showed no differ-

ences in the blood calcium and the inorganic phosphorus content of the blood serum of the 2 lots. At 6 months of age all the animals were slaughtered, and a bone analysis showed the percentage of calcium to be practically the same in both lots. From these results it was concluded that cod-liver oil had no improving effect on a standard ration for dairy calves.

[*Oat feed for*] *dairy cows.*—In 2 preliminary experiments at the Monona Farm it was found that when oat feed replaced bran to the extent of 15 or 25 per cent in the ration of dairy cows it was worth approximately 70 per cent as much as the bran.

Fermenting feed shows no advantage with dairy cows.—In a study by Rupel and B. H. Roche, 2 lots of 5 cows each were fed by the double reversal method for 3 periods of 6 weeks each. The same amount and kind of concentrates were fed to all cows, but during periods 1 and 3 lot 1 received alfalfa hay and corn silage, while lot 2 received alfalfa hay and corn fodder fermented by the Piercy process. All the cows maintained their body weight, and milk production was practically identical in both lots. No difficulties were experienced in getting the cows to eat the processed feed nor in changing from one feed to the other, but the fermentation process added greatly to the cost of the ration.

Powdered skimmilk as a feed for dairy calves, W. E. Krauss and C. H. Crawford (*Ohio Sta. Bimo. Bul., 14 (1929), No. 2, pp. 49–56, fig. 1*).—After reviewing the question of feeding calves and the feeds suitable for calves, the authors report the results of a series of experiments at the Trumbull County Experiment Farm on the economy of various methods used in raising calves.

Eight Holstein heifer calves were divided into 4 lots of 2 head each and fed as follows: Lot 1, whole milk; lot 2, farm-separated skim milk; lot 3, remixed spray process skim milk powder (1 lb. of powder and 9 parts of water); and lot 4, dry spray process skim milk powder mixed with the grain. When on full feed, lot 1 was limited to 16 lbs., lot 2 to 24 lbs., lot 3 to 24 lbs., and lot 4 to 2.4 lbs. of milk or powder daily. The other feeds used and the methods of management were the same in all groups. Weights and measurements were made of the individual calves at intervals during the 150 days of the test.

All the animals grew and increased in weight in a very satisfactory manner, and the largest daily gains were made in lot 3. Feed and labor cost of raising the calves during the period of the test was highest in lot 1, followed in order by lots 3, 4, and 2.

In a second study, a lot receiving remixed roller process skim milk and another lot receiving roller process skim milk powder with grain were added to the above lots. Again satisfactory growth was made, but when whole milk was replaced by remixed skim milk symptoms of indigestion occurred. The roller process skim milk, whether remixed or fed as a powder, cost less than the spray process skim milk and reduced the feed and labor cost of raising calves.

These studies indicate that either spray or roller process skim milk is as satisfactory as and a cheaper feed than whole milk.

The mode of inheritance of yearly butterfat production: An analysis of the progeny performance of Ayrshire sires and dams, W. Gifford and C. W. Turner (*Missouri Sta. Research Bul. 120 (1928), pp. 52, figs. 5*).—An analysis of the progeny records of 175 Ayrshire bulls having 5 or more daughters and 61 Ayrshire cows with 4 or more daughters in the Advanced Registry is presented in this study. Conversion factors (E. S. R., 50, p. 874) have been applied to all the records to obtain their mature equivalent in order that a comparative value for the cows of various ages could be obtained.

Since the progeny record of a sire is influenced by the dams to which he is mated, an effort was made to ascertain the relative effect the dam has on her daughter's producing ability. This effect was determined by means of correlation tables, which showed that for each 100 lbs. of fat increase in the production of dams there was a corresponding increase of approximately 15 lbs. of fat for their daughters.

By the use of genealogy charts it was found that the average butterfat production of the daughters of a sire is on the average a better index of the sire's transmitting ability through his sons to his granddaughters than is the dam's an index of her transmitting ability to her sons and through them to her granddaughters. These charts show that the grandparents have a small but marked influence on the producing ability of their granddaughters.

The effect of the cow's ration on the vitamin-D content of milk, W. E. Krauss (*Ohio Sta. Bimo. Bul.*, *14* (*1929*), *No. 2*, *pp. 57–59*).—The antirachitic potency of milk from cows on a high or low protein diet (E. S. R., 60, p. 472) was determined, using rats as experimental animals. The initial work in this study consisted in determining the ash content of femurs. It was found that while 10 cc. of milk from either the high or low protein ration increased the ash content of the femurs over a rickets-producing ration, the low protein ration milk caused the greater deposition of ash in the femurs.

In a second test, the rats were fed on a rickets-producing ration until severe rickets developed. At this point either 0.4 or 0.8 gm. of butterfat from each group of cows or from normal cows or 0.2 gm. of cod-liver oil was added for 10 days. Ash determinations were then made of the femurs, and the wrist bones were split, dipped in a weak solution of silver nitrate, and then exposed to bright light. By means of this latter method, it was possible to show where calcium had been deposited by the black area that appeared on the bone. Both the 0.4 and 0.8 gm. of butterfat kept the ash content of the bones above that of rats on the basal ration. However, it required 0.8 gm. of the butterfat from the high-protein ration and only 0.4 gm. in 3 of 5 cases from the low-protein ration to produce a definite healing effect upon rachitic bones.

These results indicate that cow's milk is a relatively poor source of the antirachitic factor, since practically 23 cc. of milk are required to produce normal bone formation in rats on a rachitic diet. The reason for the difference in the antirachitic factor of milk from high- and low-protein diets has not been determined.

Losing butterfat in skimmilk, J. K. Muse ([*Oklahoma*] *Panhandle Sta., Panhandle Bul. 4* (*1929*), *pp. 3–7*).—In this article the author discusses the proper method of handling the cream separator in order to avoid losses of fat in the skim milk.

[Experiments with dairy products at the Wisconsin Station] (*Wisconsin Sta. Bul. 405* (*1929*), *pp. 21, 22, 23, 24*).—Results of three experiments are noted.

Quality factors in process cheese manufacture.—H. H. Sommer and H. L. Templeton in this study found that cheeses less than 8 days or over 12 months of age did not make satisfactory process cheese because the fat separated during heating. Cheeses 3 to 6 months old were most satisfactory. A 40 per cent moisture content for process cheese was most desirable, a higher content giving a weak-bodied cheese of a grainy texture. Adding acids or alkalies to cheeses 3 to 6 months of age to change the reaction caused fat separation, and alkalies in amounts sufficient to change the reaction to a point above pH 6.3 tended to produce a bitter flavor and to discolor the tinfoil covering of the cheese. Rochelle salts added to prevent fat separation produced a sandy texture due to the formation of crystals of calcium tartrate. Increasing amounts

of disodium phosphate caused first a weak-bodied product and as the amounts increased a firmer body, but beyond a certain point fat separation and a finished product with a weak body and grainy texture. Sodium citrate in increasing amounts caused a slight decrease in body with small amounts, but as the amounts increased the body improved and in no case did it cause fat separation. It was found that heating to 145° F. during processing was necessary to guard against spoilage, that increasing the temperature produced a firmer body, and that temperatures in excess of 150 to 155° changed the color from the characteristic yellow to a pink shade.

A new process of heating curd during cheese making.—J. L. Sammis and L. Germain have perfected a process for pasteurizing cheese curd in the vat. In this process hot water is applied to the curd after milling at an acidity of 0.6 per cent. The curd is kept at 145° for 30 minutes, then cooled to 90° by adding cold water, drained, salted, and pressed. With good quality milk no improvement in the quality of cheese is noted with this procedure, but with second grade milk there is a marked improvement in the flavor and texture of the cheese. The average loss of yield with this treatment is 0.15 lb. on a 10-lb. cheese.

Ice cream quality not influenced by surface tension.—No relationship has been found between the surface tension of an ice cream mix and its whipping qualities in studies by Sommer, J. M. Coruthers, and H. Gebhardt (E. S. R., 59, p. 75).

A new method for determining the butterfat content of ice cream and ice cream mixes as worked out by Sommer et al. consists of extracting the fat with ammonium hydroxide, alcohol, ether, and petroleum ether. When 10-gm. samples are used, this method gives results accurate to 0.1 per cent fat.

[Experiments with dairy products at the Kansas Station] (*Kansas Sta. Bien. Rpt. 1927–28, pp. 97, 98*).—Two studies are noted in continuation of those previously reported (E. S. R., 56, p. 873).

Ice cream investigations.—The greatest value of egg yolk for improving the texture of ice cream was found to be in mixes with a low solid content. Egg yolk facilitated the freezing of fresh mixes regardless of composition. The freezing time was reduced and a firm consistency of the mix maintained during the freezing process when egg yolks were used in high solid mixes. Fresh yolks were found as satisfactory as dried egg yolks.

Observations showed that aged mixes developed a greater amount of swell in a shorter time than did fresh mixes. Mixes homogenized at 2,000 lbs. pressure gave a greater swell in less time than those homogenized at 4,000 lbs. pressure. The freezing time and overrun were greatly accelerated by lowering the sugar and serum solid content of a mix. The texture of finished ice cream from fresh and aged mixes was practically the same, but aging materially improved the texture of low solid mixes and had practically no effect on high solid mixes.

Bacteriological study of ice cream.—A study of the types of bacteria in ice cream mixes before and after aging indicated that whatever physical changes take place are not due to changes in the bacterial flora of the mix.

Attempts to adapt the methylene blue test to gelatin failed because of the low bacterial content of gelatin as now manufactured and also because of the rapid absorption of oxygen by the gelatin.

Viscosity in ice cream (*New Hampshire Sta. Bul. 238 (1929), p. 18*).—Continuing these studies (E. S. R., 59, p. 271), H. F. Depew found that agitation or stirring practically destroyed the apparent viscosity of an ice cream mix, while the real viscosity was not affected. Neither the overrun obtained nor the ease of obtaining it was affected by the destruction of the apparent viscosity.

Homogenization increased the viscosity of a mix by causing a greater dispersion of the fat and increasing the exposed surface of the fat, and increasing the pressure of homogenization further increased the viscosity. Homogenization also caused fat clumping and an increased absorption of protein upon the surface.

VETERINARY MEDICINE

Diseases of farm animals (*Kansas Sta. Bien. Rpt. 1927–28, pp. 109–121*).—Under the headings of miscellaneous animal disease investigations and abortion disease investigations, reference is made to 6,514 laboratory examinations, hog cholera in baby pigs and anaplasmosis in cattle. Further examinations from abortion suspect material representing 183 cases resulted in the finding of 35 per cent positive, 45 per cent negative to *Bacterium abortus* (Bang), and 30 per cent sterile bacteriologically.

In blackleg investigations a study was made of the bacteriological and immunological characteristics of *Clostridium chauvoei* and other related anaerobes. Filtrates of cultures of *C. chauvoei* grown in brain liver medium, dextrose meat mash, peptic digest broth or peptic digest meat medium, or in media containing sodium sulfite, potassium tellurite, or glucose in strengths of 5 or 12 per cent were nontoxic for guinea pigs in doses of 10 cc. subcutaneously, 5 cc. intraperitoneally, and 2 cc. intracardially or intravenously. It was found that certain salts, notably sodium citrate, potassium tellurite, and ammonium phosphate greatly increased the production of aggressive substances of backleg cultures. Sodium citrate or formaldehyde used alone doubled the strength of blackleg filtrate. When used in the same filtrate the strength was found to be four times as great as that of filtrates made by previous methods. One per cent or 5 per cent of glucose, 1 per cent of sucrose, or sodium and potassium phosphate did not affect the production of aggressive substances.

In a study of the normal susceptibility of calves to blackleg, it was found that 30 per cent of those inoculated for the production of blackleg aggressin were immune. Since about 20 per cent are normally immune, it is considered probable that a similar number are unusually susceptible to this disease. Thus, it is evident that immunity tests on cattle are of slight value unless a very large number of animals can be examined. It is concluded that the aggressive action tests which have been used since 1918 are a better indication of the potency of blackleg aggressins than animal immunity. Losses following the vaccination of cattle with blackleg aggressin and filtrate have in many cases been found to be due to an association of *C. chauvoei* with *C. septicus* or *C. welchii*. *C. welchii* especially has been found following losses of calves vaccinated in the stockyards. A study of the use of 450,000 doses of blackleg filtrate and 200,000 doses of blackleg aggressin during the past 10 years shows that these products will protect cattle under all conditions. Losses following the use of these products have been less than 1 to 10,000 head vaccinated.

Brief reference is made to studies in hog cholera immunity and the histopathology of poultry diseases. The poultry disease investigations included a general study of poultry diseases, work with bacillary white diarrhea, and studies in fowl cholera. In an examination of 2,141 fowls over 8 weeks of age made to determine the prevalence of worms in Kansas poultry, 40.8 per cent were found infested with cecum worms (*Heterakis papillosa*), 29.2 with large roundworms (*Ascaridia lineata*), 21.6 with tapeworms of all species, and 2.6 with gizzard worms. A tabulation of the distribution of lesions in avian tuberculosis shows 96.1 per cent of the total cases to be in the liver, 89.2 in the spleen, 68.8 in the intestines, 25.5 in the lungs, 19.9 in the peritoneum, 10 in the

bones and joints, 5.6 in the kidneys, 5.2 in the gizzard, 1.7 in the proventriculus, and 0.4 each in the spinal cord and pancreas.

Experiments with the agglutination, pullorin, and complement-fixation tests were conducted, accounts relating to which by Bushnell and his associates have been previously noted (E. S. R., 58, p. 576; 61, p. 73). Data obtained on the comparison of the pullorin reaction with the agglutination test are reported in tabular form. The studies led to the conclusion that the pullorin test in its present state is not so satisfactory for detecting carriers of bacillary white diarrhea as is the agglutination test.

Studies in fowl cholera led to the conclusion (1) that the organism of fowl cholera does not produce a soluble toxin in culture media; (2) that the organisms increase very rapidly in the blood of susceptible birds but disappear rapidly in the blood of immune birds; (3) that the disappearance is apparently due to a bactericidal substance in the blood of immune birds which is absent from the blood of normal birds; (4) that phagocytosis does not appear to play a very active part in this process, although it is of some importance; (5) that birds immunized by the use of living attenuated cultures are very strongly immune; (6) that the use of attenuated living cultures can not be recommended for field work because the organisms sometimes regain their virulence and cause losses in vaccinated birds; and (7) that inadequacy of diet plays a rôle in resistance to this disease. Notes on this phase are presented.

Studies of the various phases of the biology of the large roundworm (*A. lineata*) of chickens and of further search for the intermediate hosts of fowl tapeworms are referred to.

Reference is made to a study of the resistance of chickens to parasitism, an account of which by Ackert and Herrick has been noted (E. S. R., 60, p. 672). In studies relating to the embryology of parasitic worms evidence was secured of the causal relation between the filaria worm *Onchocerca cervicalis* and fistulous withers in horses. The parasites have been found in more than 75 per cent of the cases studied, and in the remaining cases it is not certain that they were absent.

[Work with animal diseases at the Wisconsin Station] (*Wisconsin Sta. Bul. 405 (1929), pp. 29–35, fig. 1*).—In testing for Johne's disease, the johnin made by the new process devised at the station the preceding year, in which a synthetic medium is used for the growth of Johne's bacillus, was found to be an accurate means for detecting infection.

In examinations made of tissues from 131 no-lesion tuberculin-reacting cattle, by E. G. Hastings and H. Mansfield, two types of organisms were found, one acid fast and the other semiacid fast. It is reported that positive reactions to tuberculin have been obtained in healthy animals that have previously been injected with acid-fast cultures known not to be tubercle bacilli.

In work with bacillary white diarrhea of the fowl there was found to be little difference between the long and short methods of applying the agglutination test. B. A. Beach and associates found 50.8 per cent of 967 eggs incubated from reacting hens to hatch live chicks and 42.8 per cent of 584 from nonreacting hens to hatch live chicks.

Reference is made to the importance of a study of the diseases of the fox. A disease termed epizootic encephalitis was responsible for the greatest number of losses during 1927–28. This disease runs a rather rapid course in foxes on a fox ranch, with a mortality seldom exceeding 20 per cent. Observations indicate that parasitic diseases are rapidly increasing in ranch-raised foxes.

A brief reference is made to the progress of studies of the relation of nutrition to abortion in cattle. The work has shown that by buying young, abortion-

free foundation stock and by keeping the animals away from other cattle, it is easily possible to establish a disease-free herd and to keep it free from the disease.

Report of the veterinary director general for the year ending March 31, 1928, G. HILTON ET AL. (*Canada Dept. Agr., Rpt. Vet. Dir. Gen., 1928, p. 49*).—A detailed report of work by the Health of Animals Branch of the Canada Department of Agriculture. Tuberculosis control and research work is reported upon in an appendix by E. A. Watson.

[Annual reports on veterinary work for the years 1926 and 1927], P. HANSEN (*Aarsberet. Vet. Fysikat. [Denmark], 1926, pp. XIV+169, pls. 2, figs. 4; 1927, pp. XIII+154, pl. 1*).—These are the usual annual reports (E. S. R., 58, p. 472) on the occurrence of and work with infectious diseases of livestock in Denmark.

Annual report of the Civil Veterinary Department of Bihar and Orissa for the year 1927–28, P. B. RILEY (*Bihar and Orissa Civ. Vet. Dept. Ann. Rpt. 1927–28, pp. [5]+23+XXVIII+5, pl. 1*).—This is the usual annual report (E. S. R., 59, p. 671).

Report on the Civil Veterinary Department, Burma (including the Insein Veterinary School), for the year ended the 31st March, 1928, A. MCKERRAL (*Burma Civ. Vet. Dept. Rpt. 1928, pp. [5]+2+26, pl. 1*).—This is the usual annual report (E. S. R., 58, p. 771).

Water-hemlock poisoning to livestock, B. L. WARWICK and H. A. RUNNELS (*Ohio Sta. Bimo. Bul., 14 (1929), No. 2, pp. 35–37, figs. 2*).—This is a brief practical account of poisoning of sheep by the spotted water hemlock, *Cicuta maculata* L., related to *C. occidentalis* Greene, studies of which in Nevada by Fleming et al. have been noted (E. S. R., 45, p. 782).

Approximately 3 oz. of new shoots were fed to a yearling lamb and an equal quantity of mature leaves was fed to a sheep, neither individual showing any noticeable ill effect. Three oz. of fresh tubers fed to one of the same animals two days later produced no symptoms of poisoning, but 6 oz. of the fresh tubers fed to the other caused death to the sheep in about 4 hours with typical spasmodic symptoms. A suckling pig given 1 oz. of the tubers in capsules showed spasmodic symptoms 4 hours later, followed by convulsions and death. Thus both sheep and swine are shown to be susceptible to the poison present in the tubers. Another species of bulb-bearing water hemlock (*C. bulbifera* L.), less common in Ohio, is said to possess the same poisoning properties.

Hypersensitiveness to helminth proteins.—I, Cutaneous tests with proteins of Ascaris, hookworm, and Trichuris in Honduras, F. A. COVENTRY and W. H. TALIAFERRO (*Jour. Prev. Med., 2 (1928), No. 4, pp. 273–288*).—In the authors' investigations hypersensitiveness to Ascaris protein was manifest in 80 per cent of 130 Honduranean patients tested by the scratch method, as shown by wheal formation and erythema within 20 minutes after testing. "This sensitiveness could not be correlated with presence of Ascaris infection, nor with the presence of other helminths. The test, therefore, has no diagnostic significance.

"Precipitin tests with Ascaris extracts, positive in 61 per cent of the 90 cases studied, could not be correlated with presence of Ascaris in the stools nor with the presence of other infections. No relation between skin reactivity and presence of precipitins in the blood could be demonstrated.

"Wheal formation and erythema followed the scratch test with hookworm extracts in 80 per cent of 84 patients' tests, but no correlation existed between the reactions and presence or absence of infection. Wheal formation and erythema followed the scratch test with Trichuris extracts in 25 per cent of

64 cases studied. Here again, no relation was found between positive tests and presence of infection."

Ticks and the bovine piroplasmoses of Algeria (preliminary note) [trans. title], E. SERGENT, A. DONATIEN, L. PARROT, and F. LESTOQUARD (*Bul. Soc. Path. Exot., 21 (1928), No. 10, pp. 846–849*).—The authors find that in Algeria *Rhipicephalus bursa* transmits the true piroplasmosis (*Piroplasma bigeminum*) and anaplasmosis (*Anaplasma marginale*), *Margaropus calcaratus* transmits babesiellosis (*Babesiella berbera*), *Hyalomma mauritanicum* transmits theileriosis (*Theileria dispar*), and *H. lusitanicum* transmits anaplasmosis of bovines.

Undulant fever: An occupational disease (*Jour. Amer. Med. Assoc., 92 (1929), No. 2, pp. 150, 151*).—In the course of this brief account attention is called to the record of more than 200 accurately diagnosed cases of undulant fever in Denmark in a single year, reported by Madsen.[1]

Infectious abortion in cattle (*Georgia Sta. Rpt. 1928, pp. 17–19*).—This is a further discussion of the work of eradicating infectious abortion from a dairy herd (E. S. R., 59, p. 275). The fact that the disease was eradicated in less than two years after the herd was found to be more 70 per cent infected is again pointed out, this having been accomplished primarily by segregating animals which were shown by agglutination tests to be infected and by observing a few simple sanitary precautions in the routine work with the cattle and about the barns, lot, and pastures.

Observations at the station and by others elsewhere have led to the conclusion that the discharges by an infected cow at the time of abortion or at time of an apparently normal calving are the chief means by which the disease is spread.

Causes of poultry mortality in North Carolina, R. S. DEARSTYNE, B. F. KAUPP, and H. S. WILFONG (*North Carolina Sta. Bul. 264 (1929), pp. 31, figs. 5*).—This is a report of the causes of mortality in 1,800 fowls received for examination by the poultry department of the North Carolina Experiment Station since the establishment of the department. The findings are reported upon for chicks, range stock, and adults month by month during the year for the various diseases in tabular form (pp. 6–9). The several classes of diseases are then considered. The relative prevalence of the several groups of diseases in the 1,800 birds was as follows: Digestive tract 22.4, glandular organs 15.7, nervous 9.4, respiratory 9.1, septicemic 7, genital tract 5.8, miscellaneous 5.5, neoplasms 5.3, nutritional 5.1, abdominal 5, constitutional 4.2, circulatory 3.5, ocular 1.3, cutaneous 0.7, and protozoan 0.6 per cent.

The insects and mites injurious to poultry in Nebraska and their control, M. H. SWENK and F. E. MUSSEHL (*Nebraska Sta. Circ. 37 (1928), pp. 31, figs. 10*).—This is a practical summary of information on the parasites of poultry met with in Nebraska and means for combating them.

Preventing the spread of coccidiosis (*New Hampshire Sta. Bul. 238 (1929), pp. 20, 21*).—In experiments by E. M. Gildow with iodine suspensoid in poultry houses as a means of preventing the spread of coccidiosis, four lots of broilers of about 1,000 birds each were raised in houses given the iodine treatment. Three treatments were given each flock, one before housing, one before the outbreak of coccidiosis, and one after the outbreak.

It was found that the iodine suspensoid treatment did not prevent the development of acute coccidiosis. The birds made better growth with a lower mortality than in previous years when no iodine treatment was given, but it is considered doubtful whether iodine suspensoid is adequate when the organism has an opportunity to multiply over a long period of intensive broiler production.

Skin vaccination for fowl pox (*New Hampshire Sta. Bul. 238 (1929), p. 19*).—In experimental skin vaccination for fowl pox with a nonattenuated virus, E. M. Gildow separated fowls into four groups, the first at 2.5 months, the second 3.5 months, the third 4.5 months, and the fourth 5.5 months. Each lot was further separated into four groups of 5 birds each, and 3, 6, 9, or 12 follicles were infected with the virus. It was found that the smaller the number of follicles infected the greater the gain in weight shown by the pullets. The lot with 3 follicles infected gained a total of 8 lbs., 6 follicles 6 lbs. 9 oz., 9 follicles 5 lbs. 9 oz., and with 12 follicles infected the gain was but 3 lbs. 14 oz. There was little difference in the weight gain between the groups of birds vaccinated at the four different ages.

Eleven months after vaccination, 9 of the pullets taken from the original lots were inoculated by rubbing virus in the comb after it had been scarified. Every 3 weeks thereafter data were taken to determine definitely the time of development of lesions. No evidence of fowl pox developed in the pullets previously vaccinated. They continued to gain weight, and 4 of the 5 pullets began laying. However, the control pullets showed fowl pox lesions. The results of this test led to the conclusion that birds vaccinated between 2.5 and 5.5 months of age, with at least 3 follicles infected, will retain the immunity developed for at least 11 months.

In experiment in which three normally healthy cockerels were placed with the pullets for 5 months no evidence of fowl pox lesions developed. When tested later two of them proved to be susceptible and the third immune, thus indicating that vaccinated birds may be placed with clean susceptible stock 4 months after vaccination without danger of spreading the disease.

In five commercial flocks that were vaccinated it was found that a slight disturbance occurred in the amount of feed consumption within 3 weeks after vaccination, but as a rule the birds recovered their appetites within a week. There was no apparent correlation between food consumption and egg production, the production in all cases remaining the same or showing a normal increase.

A study of the dissemination of bacillary white diarrhea in incubators (*Kansas Sta. Bien. Rpt. 1927–28, p. 102*).—A reference is here made to the results obtained in the continuation of the study commenced in 1925, previously noted (E. S. R., 56, p. 875; 60, p. 581). In work conducted in 1927 eggs from infected and noninfected hens were set in separate trays in the same incubator, and the chicks hatched out were taken to separate brooders and reared to two weeks of age. The chicks that died from both groups were carefully examined for *Salmonella pullorum*. In six of the eight different hatches involving several hundred eggs made during the season, there was definite evidence of transmission of the disease to the chicks from the reactor hens. The object of the present study is said to be to determine whether or not disinfectants or other agencies can be used to destroy *S. pullorum* in forced-draft incubators without injury to incubating eggs and hatching chicks.

Post-mortem examinations; testing for white diarrhea (*New Hampshire Sta. Bul. 238 (1929), pp. 30–32*).—A report is given of post-mortem examinations made of 2,625 fowls during the year. Of these, 703 specimens, of which 668 were chicks, represented bacillary white diarrhea.

A pathological condition showing approximately the same lesions as chronic duodenal coccidiosis and found in the same class of birds was enteritis, with 96 specimens in which no evidence of coccidia could be detected. Included in the 216 specimens with chronic coccidiosis and the 96 with enteritis were 151 birds

showing typical symptoms of paralysis. In practically every instance where paralysis was present there was enteritis accompanying it and in most instances duodenal coccidiosis. This is considered to substantiate the experimental conclusions that paralysis in the State is very closely associated with coccidiosis. The 421 cases of pneumonia were in practically every instance associated with bacillary white diarrhea in young chickens. It was observed that in most instances chickens suffering from a condition locally termed "crazy chicks," of which 135 specimens were diagnosed, subsequently come down with an acute form of coccidiosis. The use of a 40 per cent powdered milk mash checked it in every case in which treatment was applied.

During the year 79,539 birds in 159 flocks were tested for bacillary white diarrhea, of which 2.92 per cent were found infected.

AGRICULTURAL ENGINEERING

[Engineering investigations at the Colorado Station] (*Colorado Sta. Rpt. 1928, pp. 44–47*).—Experiments on the capping of concrete test cylinders, by E. B. House, showed that the strength of concrete cylinders varies as much as 30 per cent when capped with different materials. The Lummite cement cap gives approximately the same strength as the standard cap. It gives a slightly higher strength on the low-strength cylinders and a lower strength on the high-strength cylinders. The plaster of Paris cap, which is often used, gives a strength 30 per cent lower than the standard cap.

Tests of commercial insulating material for buildings, by C. A. Logan, indicated "the economy of insulation for the dwelling house, the main problem being that of selecting the insulating material best suited for the individual conditions. Many of the various materials have about the same insulating value but vary in their original cost, cost of application, structural strength, and appearance. It is also quite evident that a much greater efficiency is obtained by using 2½-in. thicknesses separated by an air space in place of a 1-in. thickness of the material."

Surface water supply of lower Columbia River and Pacific slope drainage basins in Oregon, 1924 (*U. S. Geol. Survey, Water-Supply Paper 594 (1929), pp. VI+215, fig. 1*).—This report, prepared in cooperation with the States of Oregon and Washington, presents the results of measurements of flow made during the year ended September 30, 1924.

Surface water supply of Hawaii, July 1, 1923, to June 30, 1924 (*U. S. Geol. Survey, Water-Supply Paper 595 (1929), pp. IV+157*).—This report, prepared in cooperation with the Territory of Hawaii, contains the results of measurements of flow made on certain streams and ditches in the Territory during the year ended June 30, 1924.

A method of farm garden irrigation, J. H. Painter (*[Oklahoma] Panhandle Sta., Panhandle Bul. 4 (1929), pp. 10–14, figs. 2*).—A brief description is given of a farm garden irrigation system which utilizes the water pumped by the farm windmill and not needed for other uses, this being collected in a simple dirt pond as the gravity distributing center.

Public Roads, [March, 1929] (*U. S. Dept. Agr., Public Roads, 10 (1929), No. 1, pp. 1–20+[2], figs. 25*).—This number of this periodical contains the status of Federal-aid road construction as of February 28, 1929, together with the following articles: Highway Traffic Analysis Methods and Results, by L. E. Peabody (pp. 1–10); and The Effect of Increased Speed of Vehicles on the Design of Highways, by A. G. Bruce (pp. 11–20).

Report of a survey of transportation on the State highways of Pennsylvania (*U. S. Dept. Agr., Bur. Pub. Roads, 1928, pp. 117, figs. 41, maps 2*).—

This report contains the results of highway traffic studies of the State primary, *secondary, and State-aid road systems of Pennsylvania* conducted during 1924 under a cooperative research agreement between the Bureau of Public Roads, U. S. D. A., and the Pennsylvania Department of Highways. The first part of the report contains a summary of the principal conclusions and the second part the evidence upon which the findings of the report are based.

Electrical equipment for farms (*New Hampshire Sta. Bul. 238 (1929), pp. 14–16, fig. 1*).—Data secured by W. T. Ackerman from three years' use of electrical equipment on seven New Hampshire farms are briefly summarized.

Nebraska tractor tests, 1920–1928 (*Nebraska Sta. Bul. 233 (1929), pp. 37, figs. 5*).—This bulletin summarizes all reports of Nebraska official tractor tests conducted since the work began in 1920 under the provisions of the Nebraska tractor law, and includes 154 different models and types of tractors. During the first four seasons of testing there were several tractors the claims of which had to be revised before they could complete the test. During the last five years, however, every tractor tested has been able to go through the test and meet all original claims made for it.

At the beginning of the tractor testing season of 1928 a new procedure was added, as follows: After the limber-up run of 12 hours is completed the tractor is given a series of brake horsepower tests, the first being a 2-hour test with the engine developing maximum horsepower at rated engine speed.

Upon completion of the 2-hour maximum test, a series of experimental runs of 20 minutes' duration is made. Starting with the 100 per cent maximum, all adjustments are made to bring about maximum horsepower at the rated engine speed. The load on the dynanometer is then changed to give rated horsepower at rated engine speed and a run of 20 minutes is made. After completing this rated-load run at maximum carburetor settings, the adjustments are all changed back to the 100 per cent maximum test and former readings verified. The load on the dynamometer scales is next reduced 1 per cent and the carburetor adjusted to a leaner mixture until this load is carried at rated engine speed. A run is then made at rated load with the above-mentioned carburetor setting. The same procedure is carried out for 98, 97, 96 per cent, and so on, of the ultimate maximum.

After the completion of the preliminary run the manufacturer is asked to select the particular carburetor setting that he desires to be used in the official tests. All official tests are then made on the setting chosen by him.

The data show "quite clearly the possibilities and advantages of a carburetor designed to operate economically over a wide range of loads without changing its adjustment. A tractor equipped with this carburetor would show good economy under field conditions where the load varies through quite a wide range."

The results also indicate that the manifolding must be very carefully worked out and should be verified by actual tests before final adoption. "The beneficial results of a good carburetor may be almost lost if it is used in conjunction with a poor manifold. Some manufacturers are fully aware of this problem and are giving it due consideration."

Winter temperature of the floors of dairy barns (*Kansas Sta. Bien. Rpt. 1927–28, pp. 96, 97*).—A study of winter temperatures of the floors of dairy barns as influenced by different materials showed that solid concrete floors compare favorably with floors constructed of building tile between two layers of concrete. The layer of concrete over the building tile conducts heat away from the cow as rapidly as the solid floor. The 2-in. plank floor warmed up more rapidly than the concrete, the rate being three to four times as fast. This was probably due to the difference in conductivity of the two materials.

Cork brick or creosoted pine block maintained about the same temperature as the plank floor. The temperature on the creosoted pine block floor compared very favorably with that on the cork brick floor. This is important because of the difference in initial cost and the comparaitve wearing qualities of the two floors.

Range shelter and adaptable poultry house, D. C. KENNARD (*Ohio Sta. Bimo. Bul., 14 (1929), No. 2, p. 60, figs. 2*).—This equipment is illustrated.

Housing farm poultry, W. A. FOSTER and H. H. ALP (*Illinois Sta. Circ. 337 (1929), pp. 24, figs. 24*).—Practical information is given on the planning and construction of farm poultry houses, together with working drawings of recommended structures.

Sewage disposal for the farm home, R. C. KELLEHER and E. W. LEHMANN (*Illinois Sta. Circ. 336 (1929), pp. 20, figs. 19*).—This circular gives directions for planning and constructing a septic tank, together with a bill of materials for the concrete forms required.

RURAL ECONOMICS AND SOCIOLOGY

[Investigations in agricultural economics at the Georgia Station, 1928] (*Georgia Sta. Rpt. 1928, pp. 6, 9–11*).—Results of investigations are reported on as follows:

Farm credit.—A study begun in 1926 showed that cotton farmers borrowing more than $300, averaging $655, paid an average of 14 per cent interest, and those borrowing $150 or less, 24 per cent interest.

Cotton marketing.—Tables are given showing staple lengths of upland cotton ginned in Georgia prior to December 1, 1928, and the estimated number of bales tenderable and untenderahle on section 5 contracts. Georgia mills in 1927 consumed 288,000 and 600,000 bales, respectively, of 7/8 and 15/16 in. cotton. The production of 7/8 in. cotton was approximately three times the requirements of the mills of the State, while that of 15/16 in. cotton was only 172,000 bales. The greater demand of the Georgia mills is for 15/16 to 1 1/16 in. lint, and there is practically no foreign competition in these grades.

[Investigations in agricultural economics at the Kansas Station, 1926–1928] (*Kansas Sta. Bien. Rpt. 1927–28, pp. 16–21, fig. 1*).—The results of investigations not previously noted are reported as follows:

[*Land values*].—A table is given showing actual and deflated selling values of farm real estate in 1910, 1924, 1925, and 1926 in the six farming regions of the State. The changes in actual and deflated values per acre from 1924 to 1926 varied as follows: Corn Belt 20 cts. and −34 cts., respectively; general farming region $2.16 and $1.12; flint hills region −$2.89 and −$2.21; eastern wheat belt $2.59 and $1.40; western wheat belt $1.61 and 91 cts.; western grazing region $1.78 and $1.10; and State average $1.35 and 63 cts., respectively. From 1910 to 1926 the State average of actual values increased $11.21 and that of deflated values decreased $4.67.

The marketing of Kansas wheat.—The differences between secular trends of top and bottom No. 2 hard winter wheat at Kansas City were found to have been 6.9 cts. per bushel in 1892–93, 9.29 cts. in 1902–3, 11.68 cts. in 1912–13, 14.07 cts. in 1922–23, and 15.27 cts. in 1927–28. The study also showed that the premium for high-protein wheat was not dependent upon the general trend of wheat prices.

The trend of cash wheat prices from July to September or October was found to be highly indicative of the subsequent general trend for the crop years, extremely large advances in April being most frequently followed by further

advances in May, declines by June, and a generally declining tendency during the succeeding crop year. The degree to which Kansas City prices depend upon Liverpool prices was found to vary with the size of the Kansas and world crops, the smallest spread being in years of small Kansas and small world crops, and the largest spread in years of large Kansas and small world crops.

The marketing of Kansas livestock and livestock products.—Some tentative conclusions are given of the investigations on when and where Kansas livestock and livestock products move to market and the economic factors influencing the time and place of such marketing. Some factors studied and their bearing found in the investigations of price trends and price-making factors in the livestock industry are as follows:

"(1) Price premiums for light and heavy fat cattle fluctuate within certain regular intervals, and these periods are easily influenced in length by the price changes in the corn crop. (2) The spread in price for the same grades of cattle at different markets varies due to a shifting in the supply which is due principally to the corn-crop influences. (3) The supply of cattle can be determined more accurately by a study of corn prices than from a study of corn-cattle ratios. (4) The price of common grades of cattle is influenced more by changes in the number of people employed than are the better grades. (5) Hide prices are a result rather than a cause of cattle prices and can not be used to determine cattle values. (6) The price of cattle appears to have little effect upon the price of hogs and vice versa. (7) The future monthly supply of hogs can be fairly accurately determined when the influence of present corn prices and the corn-hog ratios one year past are considered. (8) A price trend of hogs determined by grouping the years according to the corn crop has more significance than a statistical correlation using several influencing factors. (9) Lamb and sheep values are influenced alike by factors other than wool-price changes. Changes in wool prices affect both sheep and lamb values in nearly the same proportion. (10) The changes in the Bureau of Labor wholesale commodity index and in Fisher's index do not indicate the same trend in prices for different classes of livestock."

[Investigations in agricultural economics at the New Hampshire Station, 1928] (*New Hampshire Sta. Bul. 238 (1929), pp. 7, 8, 10, 11, 28, 29, fig. 1*).—Results of investigations not previously noted are reported as follows:

[*Use of home grown potatoes*].—More than 435,000 bu. of potatoes were shipped into the State in 1925. The chief factors influencing wholesalers retailers, and others to prefer potatoes produced out of the State, as found by E. H. Rinear, were (1) inability to buy many car lots of well-graded potatoes locally, (2) the majority of New Hampshire growers prefer to hold their crop for desirable prices and then sell their entire crop in a short time, and (3) some growers sell and deliver potatoes to consumers in small lots at the same price as to retailers.

[*Labor costs in producing potatoes*].—The hours of labor spent per acre in producing potatoes in 1927 were for digging 47.6, hauling to market 20.1, planting 14.5, cultivating 10.9, fitting the soil 5.5, spraying or dusting 5.4, manuring 2.2, plowing 6, and miscellaneous operations 2.7, as found in a study by M. F. Abell.

[*Grain costs*].—A study by Rinear of weekly prices of 53 retail dealers and a number of wholesale distributors showed the following differences: Poultry wheat as high as 75 to 95 cts., corn from 20 to 30 cts. per hundredweight, and oats from 8 to 12 cts. per bushel.

Time studies in orchards.—Filler trees in apple orchards were found by H. C. Woodworth and G. F. Potter to have little value under New Hampshire condi-

tions with cheap land and the sod mulch system. With permanent trees the highest value, based on earnings, seemed to come at 20 years of age. The studies indicated that two skilled men with extra unskilled help at certain seasons could care for 3,000 trees. Machinery and personnel sufficient to spray in 40 hours are recommended for the large orchards.

[**Rural economics investigations at the Ohio Station**] (*Ohio Sta. Bimo. Bul., 14 (1929), No. 2, pp. 61–64, fig. 1*).—Results of investigations in rural economics are reported as follows:

Receipts of produce on the Columbus wholesale curb market, C. W. Hauck (p. 61).—A table is given showing by months, July to December, inclusive, 1928, the truck loads of produce, by county of source, offered on the Columbus curb market.

Comparative prices of Ohio farm products, J. I. Falconer (pp. 62, 63).—A table is included showing the average prices and index of prices of various agricultural products in 1910–1914, 1921–1924, 1925–1928, and 1928. The indexes for all products were 100, 131.5, 153, and 154 for the respective periods.

Beef cattle prices in Ohio, J. I. Falconer (p. 63).—A chart is presented showing from 1910 to 1928, inclusive, the Ohio farm price for beef cattle, the number of beef cattle in the United States, and their purchasing power in terms of the 1910–1914 dollars.

Index numbers of production, prices, and income, J. I. Falconer (p. 64).—The table previously noted (E. S. R., 60, p. 782) is brought down through November, 1928.

[**Investigations in agricultural economics at the Wisconsin Station, 1927–28**] (*Wisconsin Sta. Bul. 405 (1929), pp. 10–18, figs. 3*).—Results of investigations not previously noted are reported as follows:

[*Buttermilk drying*, M. A. Schaars] (pp. 12–14).—The cost of drying buttermilk or skim milk was found to vary from 2.5 to 3.5 cts. per pound of powder. The net price at the creamery for buttermilk and skim milk powder averaged from 7 to 7.5 cts. per pound in 1927, and from 6 to 6.5 cts. in 1928. At these prices the creameries studied by drying buttermilk increased the returns on buttermilk from an average of 16 cts. per 100 lbs. of butterfat received received at the creamery to 93 cts. Cooperative drying plants are suggested for gathered cream creameries making less than about 750,000 lbs. of butter per year and for creameries receiving whole milk and making less than about 500,000 lbs. of butter.

[*Costs of raising heifers*, P. E. McNall and D. R. Mitchell] (pp. 16–18).—A study of records kept on over 100 farms in Fond du Lac and Walworth Counties showed the costs of raising a 2-year-old heifer to be approximately as follows: Feed $71, pasture $6, man labor $9, barn costs $7, interest $3, and taxes, insurance, and other items $4. Tables are given showing the amounts of different kinds of feeds used on the farms, and also a suggested feed standard for heifers.

The Iowa agricultural outlook for 1929, C. L. Holmes (*Iowa Sta. Cur. Econ. Ser. Rpt. 8 (1929), pp. 39, figs. 3*).—This report discusses and interprets the material and statements of general conditions presented in the report previously noted (E. S. R., 61, p. 82) as they relate to Iowa agriculture.

Types of farming in North Dakota, F. F. Elliott, J. W. Tapp, and R. E. Willard (*U. S. Dept. Agr., Tech. Bul. 102 (1928), pp. 55, figs. 18*).—This bulletin reports a study made in cooperation with the North Dakota Agricultural Experiment Station.

Using the physical factors—soil type, topography, length of growing season, and precipitation; the nature of crop and livestock organizations; and the trend in acreage of crops and numbers of livestock, together with some con-

sideration of variations in crop yields and of the proportion of the total income from different sources, the State is divided into 14 type-of-farming areas of one or more counties each. The method of arriving at the typical farming system or systems in a given area is outlined, and tables are given showing for each of the type-of-farming areas the typical farming systems for farms of different sizes.

The possible use of the results of the study in outlining agricultural programs, in determining profitable adjustments in production, and in planning other studies is discussed.

The effect of the combined harvester-thresher on farm organization in southwestern Kansas and northwestern Oklahoma, W. E. GRIMES, R. S. KIFER, and J. A. HODGES (*Kansas Sta. Circ. 142 (1928), pp. 24, figs. 6*).—This circular, prepared in cooperation with the U. S. D. A. Bureau of Agricultural Economics and the Oklahoma Experiment Station, discusses primarily the problems of size of farm and the combination of crops and livestock most desirable for farms of various sizes in southwestern Kansas and northwestern Oklahoma. A table is given showing the power and crew requirements, number of cutting days required, and cost per acre of harvesting 50, 100, 200, 300, 400, and 500 acres with binders, headers, and combines. Plans are outlined for the organization of farms with 360, 480, and 960 acres of wheat, and tables are included showing the estimated receipts, expenses, and financial statement for such farms. The land needed for other crops and pasture, cropping systems, livestock needed, equipment, capital requirements, etc., are discussed.

Economic aspects of the cattle industry of the Nebraska Sand Hills, H. HEDGES (*Nebraska Sta. Bul. 231 (1928), pp. 42, figs. 5*).—The economic analysis of the cattle industry in the Sand Hill area of Nebraska here reported is based upon a study of 47 ranches for the years 1924–25 to 1926–27, inclusive, made in cooperation with the Bureaus of Agricultural Economics and Animal Industry, U. S. D. A.

Tables are presented and discussed showing for each year the averages per ranch for receipts by items, expenses by items, changes in inventory, capital, real estate and chattle mortgage indebtedness, interest costs, sources of real estate and chattle loans, ranch and labor income, and return on operator's equity. Other tables show averages for the 47 ranches and for the 10 best and the 10 poorest ranches of receipts for each $1 of expense, percentage of calf crop, death losses, labor cost per head of cattle, labor requirements per 100 head, cattle receipts per $1 expended for labor, rates of turnover on total investment and on investment in cattle, beef production per head, and the number, weight, and value per head of different classes of cattle, yearlings or older, sold. The average breeding herd cost, by items, per cow and per calf for each year on 38 ranches, and the average labor income, by groups of ranches based on number of cows, are also given.

The average labor income of operator and the percentage of return on operator's equity for the 3 years were −$1,312, $2,237, and $867, and 0.6, 8.8, and 5.4 per cent, respectively, for the 47 ranches; $757, $4,982, and $3,147, and 5.4, 15.4, and 10.5 per cent, respectively, for the 10 best ranches; and −$2,862, $66, and −$1.688, and −2.8, 4.3, and −1 per cent, respectively, for the 10 poorest ranches.

A comparison between the 10 best ranches and the 10 poorest ranches showed for the former receipts per $1 of expense of from 41 to 55 per cent higher, percentage of calf crop 9.1 to 13.8 per cent higher, labor cost per head of cattle 24 to 97 cts. less, months of labor per 100 head 0.2 to 1.6 less, cattle receipts per $1 of labor $1.12 to $1.94 more, percentage of total receipts to total

investment 4.8 to 8.5 per cent more, percentage of cattle receipts to cattle investment 5.6 to 10.4 per cent more, and beef production per head from 5 to 37 lbs. more.

The average labor income per ranch for the 3 years was $597 for the 47 ranches, $354 for those with less than 150 cows, $530 for those with 150 to 299 cows, $476 for those with 300 to 449 cows, and $1,280 for those with 450 or more cows.

An economic study of 93 apple farms in Oxford County, Maine, 1924–1927, C. H. MERCHANT (*Maine Sta. Bul. 347 (1928), pp. 61–144, fig. 1*).—This bulletin is based upon data obtained by personal visits in the summers of 1925, 1926, and 1927 to each of 93 commercial orchards and covers the 3-year period from April 1, 1924, to March 31, 1927. The average size of farms for the period was 174.98 acres, of which 39.02 acres were in crops, 124.27 acres in pasture and woods, and 11.69 acres in farmstead, roads, etc. The average acreage in apples was 4.7 acres per farm.

Summary tables are given showing, by items, the totals for each year, the average of the totals, the average per farm, and the percentage of the totals for the 3-year period for capital invested, receipts, expenses, farm income, interest on capital, and labor income; and the costs and returns (total, percentage of total, and per barrel) in producing apples, by items, for each year and the averages for the period. Other tables given and discussed present additional data for the several items. Tables are also given and discussed showing the number, age, condition, and production of trees, the varieties of apples produced, plantings and varietal trends during the period, various phases of orchard management, etc.; the production by grades and varieties, freight rates, monthly sales of graded apples, and methods of selling winter, fall, and summer varieties; and the average prices in barrels and in bulk for the 3-year period by varieties and grades.

The advantages and disadvantages of the principal combinations of enterprises found on the farms are discussed. The average labor income per farm was $272.86 in 1924–25, $170.75 in 1925–26, and $77.96 in 1926–27. For the 3-year period an average of 2.3 farms had a farm income over $2,000, 7.4 farms from $1,001 to $2,000, 44.7 farms from $1 to $1,000, 32.6 farms from zero to —$999, and 6 farms —$1,000 or over.

Three-year averages for the factors of the farm business for the 10 most successful farms were found to exceed those for the 93 farms as follows: Capital $459, acres of crops 2.01, acres of pasture 11.15, number of bearing trees 270, number of nonbearing trees 118, productive man work units 145, productive horse work units 88, acres of crops per animal unit 0.25, value of purchased fertilizer per acre 77 cts., receipts from crops $684, receipts from livestock $284, miscellaneous receipts $410, crop index 7, returns per productive animal unit $29, productive man work units per man 89, acres of crops per man 1.24, productive horse work units per work animal 8, and value of machinery per crop acre 96 cts. For the following factors the average of the 93 farms exceeded the average of the 10 successful farms, as follows: Number of animal units 0.38, acres of crops per work animal 4.96, and the percentage of capital invested in buildings 2.94.

The cost of handling fluid milk and cream in country plants, C. K. TUCKER (*New York Cornell Sta. Bul. 473 (1929), pp. 119, figs. 11*).—This bulletin reports the results of a study to determine the costs of handling fluid milk and cream in country plants and the effects of various factors upon the efficiency of operation. It is based upon records and data regarding operating costs, volume of product, distribution of labor, and other information obtained

for the fiscal years ended, for the different firms, from March 31 to December 31, 1925, and from 38 plants selling raw milk in 40-qt. cans, 18 plants selling pasteurized milk in 40-qt. cans, 15 plants selling pasteurized milk in bottles, and 10 plants selling cream in 40-qt. cans.

Tables are given and discussed showing for each type of plant (1) the elementary costs—land and buildings, equipment, management and labor, supplies, and miscellaneous costs; (2) the different intermediate costs—steam generation, ice-machine operation, water supply, and general cleaning; and (3) the distribution of the elementary and immediate costs to the various operations. Tables are also included with explanatory text showing the annual operating costs in a milk plant making Cheddar cheese and one making heavy cream, condensed milk, and by-products.

The average annual costs of operating the 81 plants were for raw milk plants $16,164.11, pasteurizing plants $17,239.91, bottling plants $68,746.66, and cream plants $51,316.86, being 22.9 cts., 32.8, 61.3, and 161.7 cts., respectively, per 100 lbs. of milk. The volume of milk handled, investment in plant and equipment, arrangement of plant, seasonal receipts of milk, and method of refrigeration were factors affecting the cost per 100 lbs. of milk, the volume of milk received being the most important factor. Land, building, and equipment costs constituted from 24.4 to 31.8 per cent of the total costs of operation and were not much greater in the plants handling a large volume of milk than in those handling a small volume. Variations in receipts of milk at different seasons increased the costs of operation. The use of natural ice was found to be more economical than mechanical refrigeration in plants the annual receipts of which were less than 8,000,000 lbs. of milk. The purchase of water from public supplies was generally cheaper than pumping. Cooling was the most expensive operation in the raw milk, pasteurizing, and cream plants, and bottling in the bottling plants.

Wheat prices and the world wheat market, V. P. Timoshenko (*New York Cornell Sta. Mem. 118 (1928), pp. 100, figs. 27*).—The principal subject of this study, which was made in cooperation with the International Education Board, is the major factors in the period 1890 to 1913 determining wheat prices in the representative world market for wheat and in the markets of some of the leading countries exporting and importing wheat. The world wheat market during pre-war years, its development from 1894 to 1913 and since the World War, and the limitations of the method of correlation in such a study as the present one are discussed.

The analysis covers the following phases: (1) The Liverpool wheat price and the factors determining it, including the studies of the spring-fall prices, carryover and prices, influence of rye production on wheat prices, and winter-spring prices; (2) international trade in wheat and its relationship to wheat prices, under which are considered the effects of production on imports, of imports on prices, of prices on imports, and of the rye crop on wheat imports; (3) the relationship between production, exports, and prices of wheat in the United States and in Russia; (4) wheat prices on the interior terminal markets in the United States and in Russia, including the studies of crop-year prices, seasonal prices, interrelation of interior market prices, prices and yield of spring wheat, influence of quasi-periodicity in yields and prices, winter wheat yield and spring wheat prices, world wheat production and spring wheat prices in the United States, prices of hard winter wheat, terminal market prices and farm prices, and Russian wheat prices; and (5) prices of wheat at Paris and Berlin, interior markets in two wheat-importing countries, 1885–1913.

As to changes in Liverpool prices from spring to fall, it was found that they are closely correlated with Northern-Hemisphere production, and that prices re-

spond more to the fluctuations of production in the east-European surplus and in the west-European deficient areas than to North-American production. Berlin and Paris prices show the same tendency. Fluctuations of wheat production in different areas show very little correlation. The addition of the world visible supply to the production did not greatly affect the correlation between price and production. The coefficient of multiple correlation between the changes of Liverpool prices from spring to fall and the production in the three previous years was 0.94, indicating that demand affects the short-time fluctuations of prices only slightly. World rye production, eliminating the association between rye and wheat production, shows little correlation with changes in the Liverpool wheat prices from spring to fall.

Changes in Liverpool prices from fall to winter and from fall to spring were found to respond less regularly to the fluctuations in Southern-Hemisphere production than changes in prices from spring to fall respond to Northern-Hemisphere production.

Imports of wheat into Europe respond more to production in the European deficient area than to the crop in the surplus area. They are correlated fairly closely with production in the east-European surplus area, but only slightly with North- and South-American production. Liverpool prices are more closely related to the wheat directly at the disposal of western Europe (west-European production plus imports) than to the world production. The difference between the prices on importing and exporting markets, rather than the absolute level of wheat prices on importing markets, determines the amount of international trade in wheat. Imports of wheat into Europe are not correlated with rye production in Europe when the association between rye and wheat production is eliminated.

Russian wheat exports and production are highly correlated. United States exports are less affected by the size of the crop. Russian exports are negatively correlated with prices on Russian interior markets. The negative correlations between exports and prices on interior markets of the United States are small. Prices on United States interior markets are generally more closely correlated with world production than with the interior crop. The reverse is true in Russia. Interior terminal market prices in the United States are more closely correlated with export harbor market prices and with Liverpool prices than is the case for Russia.

Spring wheat prices in the United States are fairly closely correlated with yield per acre. Hard winter wheat prices are only slightly correlated with yield. The association between prices and the yield of spring wheat increased when the influence of the two preceding crops was considered. Multiple correlation between prices and the yield of spring wheat in the United States in three consecutive years is as high as, or higher than, the correlation between spring wheat prices and world wheat production. Farm prices of spring and of hard winter wheat in surplus areas in the United States are closely correlated with market prices on corresponding terminal markets. Russian interior prices are more closely correlated with Russian than with world production. In Russia, crop influences prices during at least three following years and, as in the United States, positive correlation exists between prices and the yield two years previous.

Prices of wheat in France and Germany, wheat-importing countries, are fairly closely correlated with home production. In France prices are equally correlated with home yield and with world production. In Germany the correlation is closer with world production. The prices in both countries are only slightly correlated with North American production. They are more closely

correlated with east-European production. The preceding crops affect prices only slightly in the two countries.

An appendix (pp. 89–93) describes the method of the moving or sliding coefficient of correlation proposed by N. S. Chetverikov (Tschetwerikoff).[2]

Country elevator margins and costs in marketing Kansas wheat, **R. M. Green** and **E. B. Ballow** (*Kansas Sta. Bul. 246 (1928), pp. 60, figs. 7*).—The results reported in this bulletin are based chiefly on a study made in cooperation with the Bureau of Agricultural Economics, U. S. D. A., of detailed data obtained from 29 mill line, 13 commercial line, 11 cooperative line, 4 cooperative independent, and 2 commercial independent elevators for the year 1921–22, and from 74 mill line, 39 commercial line, 21 cooperative line, 49 cooperative independent and 6 commercial independent elevators for the year 1922–23.

Tables are given for each year and discussed showing for the different types of elevators (1) the number of bushels of grain handled, (2) the total, fixed, and variable operating costs in cents per bushel, and the percentage of total costs, (3) the important items composing variable and fixed costs in cents per bushel, (4) the price paid producers, gross margin, local operating expense, and profit or loss, and (5) an analysis of the business of the elevators with and without side lines. Other tables show (1) for individual elevators of different types in 1921 and 1922 the number of bushels of grain handled, operating margin, operating cost per bushel, and net operating profit or loss, (2) for 1921–22 the percentage of sales by various methods of sale, (3) the average operating cost, 1922–23, by items for groups based on the number of bushels handled and the percentage of variations of such costs from the average costs for all elevators, and (4) the average local elevator operating costs by items and the average buying margins, 1920–21, 1921–22, and 1922–23.

From 60 to 85 per cent of the elevators reporting attempted to buy wheat on a margin of from 4 to 6 cts. per bushel. The study showed that to cover all legitimate costs an average buying margin of 7 or 8 cts. was necessary, the average operating cost, excluding salary and interest for the 3 years, being 5.1, 5.2, and 5.3 cts. per bushel, respectively. The average volume of grain handled per elevator for the 3-year period varied from 13.2 per cent below to 18 per cent above the average. Average costs per elevator varied only from 8.4 per cent below to 12.3 per cent above the average. The operating cost per bushel for the elevators studied in 1922–23 averaged 8.02 cts. for the 121 elevators handling less than the average volume (70,310 bu.) and 4.76 cts. for those handling more than the average volume. The items composing fixed costs, before including interest and shrinkage, represented 71.6 per cent of the total operating costs in 1921 and 76 per cent in 1922. Salaries and buildings and equipment constituted 73.8 and 22.5 per cent, respectively, of the costs in 1921.

Added volume handled seemed to reach its maximum effect in reducing salary and wage cost per bushel in the group of elevators handling from 100,000 to 125,000 bu. An analysis of the 1922 data showed that for elevators doing the same volume of business the differences in operating costs per bushel were accounted for as follows: Management and labor, 50.4 per cent; taxes, 12; repairs, power, and light, 6.6; depreciation, 16.7; and miscellaneous operating, office, and general administration expenses and insurance, 14.3 per cent.

The limited study made of the possible advantage to country elevators of hedging in the future's market against purchases showed that the elevators purchased about 70 to 75 per cent of the crop in the first 6 or 7 months of the crop

---

[2] Correlation between grain prices and crops [trans. title]. Voprosy Kon''i͡unktury (The Problems of Economic Conditions). Prilozh. Zhur. Ekon. B͡iul. Kon''i͡unktur. Inst. (Sup. Mo. Econ. Bul. Conjuncture Inst. [Moscow]), 1 (1925), No. 1, pp. 80–112, figs. 7; Eng. abs., pp. 183, 184.

year and shipped about the same amount in the same period, and that, except in years of almost continuously declining prices, no great saving could be effected by hedging purchases.

Marketing late-crop potatoes, W. A. Sherman, G. B. Fiske, and J. W. Park (*U. S. Dept. Agr., Farmers' Bul. 1578 (1929), pp. [2]+46, figs 16*).—"This bulletion discusses some of the underlying facts and conditions that influence prices, the sources and character of the information the grower should use, and the differing marketing problems of the producers of the late or main crop. The location and relative importance of the heavy shipping districts are shown, with brief descriptions of their methods of marketing. Practices in important city potato markets are described."

Roadside marketing in Michigan, H. P. Gaston (*Michigan Sta. Spec. Bul. 185 (1929), pp. 49, figs. 27*).—This bulletin presents the results of a study begun in the summer of 1926 and continued through the fall of 1927, during which time more than 500 roadside markets were visited and detailed information obtained. The bulletin is devoted largely to describing and discussing the classes of people purchasing at such markets, the kinds of farm products or other commodities purchased, the size of purchases, types of containers, grades of products preferred, prices, distribution of seasonal, weekly, and daily business, location of market or stand, type of market or stand, parking facilities, salesmanship, advertising, costs, and other phases of roadside marketing.

Observation and experiments made and records kept showed among other things the following facts: Of 2,000 automobiles stopping at roadside markets 41 per cent cost less than $1,000 and 51 per cent between $1,000 and $1,800. The percentages for roadside stands were 72 and 25, respectively. Of the purchases made 49 per cent were by women, 31 per cent by men, and 20 per cent by men and women together. At 11 representative markets 24.1 per cent of the total season's business was in sweet cherries, 14.3 per cent in cider by the gallon, and 13.8 per cent in berries. Of 2,000 customers at representative markets 52 per cent purchased farm products, 29 per cent manufactured products, and 19 per cent both. A comparison of the sales of peaches for a week by 2 markets on opposite sides of the road showed that 17.5 bu. were purchased by cars coming from the city, as compared with 104 bu. by cars going toward the city. Of the inbound purchases, 87 bu. were in bushel baskets, as compared with 3 bu. for the outbound purchases.

Prices at 100 roadside markets were compared with those for products of similar kind and grade at retail stores in near-by towns. In 68 cases there was practically no difference in price, in 14 cases the roadside market prices averaged at least 10 per cent higher, and in 18 cases at least 10 per cent lower than city prices. Data obtained from 80 markets near one large city showed that a market location on the right side of the road approaching the city does $100 worth of business, as compared with $47 for a market location on the left side of the road. Stops at 12 markets studied simultaneously showed that only 78 per cent as many stops were made at markets on the left-hand side as at those on the right-hand side of the road approaching the city. Sales at 2 similar stands near each other for 2 weeks each during the sweet cherry and apple seasons showed total sales of $311 for the market with an attendant, as compared with $72 for the market for which an attendant came from a near-by farmhouse only when customers stopped. By alternating the size of display of fruit in 2 markets, it was found that the average weekly sales with a 3-bu. display was only $20, as compared with $98 with a 30-bu. display. Saturdays, Sundays, and holidays were the best days for sales, and from 10 a. m. to 12 m. and from 2 to 5 p. m. the best hours for sales. The records of 12 representa-

tive markets doing business of $20 or more a day showed that the cost of marketing at the roadside constituted 40 per cent of what the customers pay.

Crops and Markets, [March, 1929] (*U. S. Dept. Agr., Crops and Markets, 6 (1929), No. 3, pp. 81–112, figs. 2*).—The usual tables, graphs, reports, summaries, and notes are given covering cold storage holdings, cotton, crops of different kinds, livestock and livestock products, dairy and poultry products, feedstuffs, fruits and vegetables, grain, hay, seeds, and prices.

Tables are included showing by States for 1928 and 1929 with comparisons with other years and periods of years (1) the quantity and percentage of the previous crop of wheat, oats, corn, barley, and rye on farms March 1; (2) the percentage of the last crop of the several grains shipped out of the county where grown; (3) the percentage of the last crop of corn that was merchantable; and (4) the quantity and percentage of previous crop of wheat in country mills and elevators on March 1.

Relation of farm families to organizations (*Wisconsin Sta. Bul. 405 (1929), pp. 18–20, figs. 2*).—Preliminary summaries of the study by J. H. Kolb and E. L. Kirkpatrick in Burnett, La Crosse, Racine, Rock, and Walworth Counties of individual farm families in relation to their local community organizations showed that 75 per cent of the families were affiliated with some kind of local community organization, that the mode had members affiliated with two organizations, that 75 per cent had one or more members attending church, but that 80 per cent had no members attending Sunday school or religious instruction regularly. Families who have lived on their present farms at least 6 years had the largest organization connections.

Of the individuals studied, 39 per cent belonged to 1 community organization, 13 per cent to 2, and 6 per cent to 3, but 36 per cent of the individuals 10 years of age or over had no affiliations. Seventy-five per cent of the individuals participated in 6 or more types of recreation during the year, the most frequent recreations being reading 99 per cent, automobile rides and trips 89, picnics 86, playing cards 70, attending motion-picture shows 63, and plays 46 per cent. Two-thirds of the families took 1 daily paper, one-fifth 2 daily papers, and one-third 1 or more weekly papers. Eighty-eight per cent of the families took some sort of magazine, and the mode took 3 or 4 magazines.

Owner families reported greater satisfaction with recreational opportunities than did renter families.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Extension methods and their relative effectiveness, M. C. Wilson (*U. S. Dept. Agr., Tech. Bul. 106 (1929), pp. 48, figs. 32*).—The basic information for this bulletin was collected by the survey method from 9,287 farms in 27 counties in 13 States during the period 1923 to 1928, inclusive, by representatives of this Department and the State extension services.

The percentage of farmers adopting agricultural practices varied from 59 to 96 in the different areas, and the percentage of women adopting home economics practices from 10 to 65 per cent. The number of practices adopted per 100 farms or homes varied in the different areas from 139 to 403 for agricultural practices and from 10 to 177 for home economics practices. Of 27,032 practices adopted in 12 of the States, the following percentages were due to different extension methods: Indirect influences 21.31, method-demonstration meetings 15.18, general meetings 13.80, farm or home visits 12.34, news stories 10.27, office calls 6.75, bulletins 6.52, adult result demonstrations 4.14, junior result demonstrations 2.53, circular letters 1.53, radio 1.53, correspondence 1.23,

leader-training meetings 0.92, extension schools 0.77, exhibits 0.61, telephone calls 0.38, study courses 0.15, and posters 0.04.

The value of the several methods is discussed with tables showing the percentages of all improved practices adopted in the several areas in the different projects as the result of the influence of the different methods, and graphs are given showing by areas the total practices adopted per 100 farms and the practices credited to method demonstrations, adult result demonstrations, news stories, office calls, and indirect influences. The adaptability and effectiveness of the various methods to and in the various lines of subject matter are discussed with graphs showing the percentages of practices adopted as the result of different extension methods, as indicated in the adoption of 20,832 agricultural, 6,200 home economics, 914 wheat, 1,104 corn, 1,244 soils, 975 alfalfa, 340 soybean, 943 other legume and forage crop, 1,191 potato, 236 cotton, 1,073 tree-fruit, 177 vegetable, 2,439 poultry, 2,503 dairy, 1,002 swine, 1,034 marketing, 688 rural engineering, 601 food preparation, 1,859 preservation, 489 nutrition, 200 home management, 154 home improvement, 2,171 clothing, and 241 health and sanitation practices, and also showing a comparison between 2,171 clothing and 1,191 potato practices.

Charts are also included showing for the 27,032 practices adopted the relation of time spent on practices credited to different methods and the comparative efficiency of the several methods.

Data from 424 alfalfa growers in a Wisconsin area, 192 dairy farmers in a New Jersey area, and 612 poultry keepers in an Ohio area are presented in tables and charts showing the percentage of farmers exposed to the several methods and the percentage of those exposed who were influenced. A table is also given for the dairy farms making comparison of adult extension and junior extension methods.

The study shows that approximately 93 out of 100 practices adopted were credited to method and result demonstrations, general meetings, news stories, bulletins, farm or home visits, office calls, and indirect spread of influence. The results per unit of time devoted to the methods were as follows: News stories 3.55, bulletins 3.27, general meetings 1.54, office calls 1.42, farm or home visits 1.13, method-demonstrations and leader-training meetings 1.04, circular letters 0.66, adult result demonstrations 0.57, junior result demonstrations 0.51, extension schools 0.47, correspondence 0.25, telephone calls 0.23, and exhibits 0.20.

More than four times as many practices per 100 farms were adopted by farmers having contact with extension workers than by those having no such contact.

Cooperative extension work, 1926, C. B. SMITH ET AL. (*U. S. Dept. Agr., Coop. Ext. Work, 1926, pp. 119, figs. 30*).—This is the report on the cooperative extension work in agriculture and home economics of this Department and the State agricultural colleges, and covers the year ended June 30, 1926, for funds expended, and the year ended December 31 1926, for results of work. The funds and staff; outstanding teaching methods; programs; usefulness of publications, visual aids, and radio; efficiency of extension work; and farmers' institutes are discussed.

The economic results are reported and described under the headings of distribution of extension activities, improved practices adopted, demonstrations completed, soil improvement, the different field and horticultural crops, crop diseases, forestry, the different kinds of livestock, entomology and bee culture, rodents, rural engineering, farm management, marketing, foods, nutrition, clothing, home management, child care and training, home furnishing and

beautification, and home health and sanitation. The personnel, programs and plans of work, development of work, local leadership, methods of extending information, developments, achievements, and other phases of county agricultural agent work, home demonstration work, boys' and girls' 4-H club work, and negro extension work are described and discussed.

Pages 84–118 are devoted to statistical tables.

A manual for poultry club members, E. I. Pilchard and J. Vandervort (*Illinois Sta. Circ. 335 (1929), pp. 26, figs. 11*).—Instructions and information are given for boys' and girls' poultry club members enrolled in egg-setting and flock-management projects.

FOODS—HUMAN NUTRITION

A study of the change in the ash content of vegetables during storage and cooking (*Kansas Sta. Bien. Rpt. 1927–28, p. 125*).—Radishes, carrots, onions, potatoes, turnips, parsnips, and Jerusalem-artichokes were the vegetables used in this investigation. The results thus far obtained are summarized as follows:

"(1) There was great variation in the amount of the three ash constituents present in different varieties of the same vegetable grown under different conditions. For example, white onions exceeded red onions by more than 35 per cent in total ash. This difference was largely in the phosphorus and iron content. Mature carrots showed a higher per cent of all three elements than the immature carrots. Texas carrots were lower in ash than Kansas carrots. (2) The alcohol-soluble sugars in parsnips increased during storage, the amount of the increase being governed by the time in storage and by the temperature. (3) The total carbohydrates in parsnips decreased during storage, the amount of the decrease being governed by the time in storage and by the temperature."

Chemical factors influencing quality of wheat and flour (*Kansas Sta. Bien. Rpt. 1927–28, p. 50*).—The observation that one of the factors in dough development is the dispersion of the phosphatides with production of alcohol and acids as by-products has led to the discovery that by adding alcohol, acids, and water-soluble phosphatides to the dough, or by using oxidizing agents such as chlorates and bromates, it is possible to dispense with all fermentation except that in the pan, with the result that bread may be made in two hours from the time the mixing starts.

Soybeans and their utilization in the organism, from metabolism experiments on man [trans. title], R. O. Neumann (*Arch. Hyg., 99 (1928), No. 1–2, pp. 1–51*).—The author reviews the literature on the production and composition of soybeans, the manufacture of soybean flour, and previous studies on its utilization as determined chiefly by metabolism experiments on mice, and reports metabolism experiments conducted on human subjects with bread made from a mixture of rye-wheat flour and soybean flour, the latter comprising 20 per cent of the bread. On this as a sole diet with the exception of water the nitrogen balance remained positive until after seven diet periods of four days each, when there was a slight negative balance and a loss of 1.6 kg. of body weight. The total dry weight of the feces was higher on the soybean bread than on rye-wheat bread alone. The nitrogen content of the feces was also higher, but this was attributed to the ingestion of more nitrogen. From one-third to one-fifth of the ash of the bread was lost in the feces. It is concluded that the soybean bread is less well utilized than rye-wheat bread.

The nitrogen, calcium, and phosphorus metabolism in infants fed on soybean "milk," E. Tso, M. Yee, and Tung-Tou Chen (*Chinese Jour. Physiol.,*

2 (1928), No. 4, pp. 409–414).—Supplementing earlier studies on the utilization of soybean milk (E. S. R., 60, p. 492), the authors have determined the nitrogen, calcium, and phosphorus metabolism of two infants 3½ and 6 months of age at the beginning of the experiment, receiving soybean milk as their principal food. The nitrogen balances were positive in all cases. The percentage utilization varied from 68.8 to 76.5 in the first subject and from 87.1 to 87.3 in the second. The dried weight of the feces was comparable to that on cow's milk, indicating a high coefficient of digestibility of the bean milk. The calcium intake was inadequate and the absorption amounted to 30 per cent of the intake. The addition of cod-liver oil and a small amount of calcium salt increased not only the calcium retention but also that of phosphorus. The phosphorus content of the soybean milk was apparently adequate and its utilization restricted only by the limited calcium intake.

Acidified milk for infant feeding (*Wisconsin Sta. Bul. 405 (1929), pp. 22, 23*).—Further feeding trials with infants have given satisfactory results in the use of citric acid in place of lactic acid in the modification of milk (E. S. R., 59, p. 92).

Factors affecting the seasonal variation in the growth curve of children (*Kansas Sta. Bien. Rpt. 1927–28, pp. 122, 123*).—Monthly weight records through the school year of 65 healthy children from a State institution for the deaf showed definite seasonal variations in growth, the gains in weight being greater in the fall than in the late winter. There was even a loss in weight during April. The children were divided into three groups, one receiving no treatment, one ultra-violet treatment, and one supplementary orange juice equivalent to two oranges per person per day. This appeared to have no effect upon the seasonal variation in growth. The boys showed greater variations in growth and smaller actual gains during the school year than the girls.

Physical development and the excretion of creatine and creatinine by women, P. Hodgson and H. B. Lewis (*Amer. Jour. Physiol., 87 (1928), No. 2, pp. 288–292*).—Determinations of the creatinine excretion and the frequency of creatinuria in 14 college girls of unusual physical development who were pursuing professional courses in physical education gave creatinine coefficients of the same order of magnitude as those of men. This is thought to support the theory that urinary creatinine is independent of sex, per se, and is an index of the proportion of muscular tissue to the total body weight. The frequency of creatine excretion in the urine was similar to that usually observed in women, indicating that creatinuria in women is probably not related to the usual differences in muscular development between men and women.

The energy consumption during sports (canoeing), I [trans. title], T. Wohlfeil (*Arch. Hyg., 100 (1928), No. 8, pp. 393–411, figs. 2*).—Investigations with a modified Douglas bag method on the energy consumption during canoeing gave for long-continued exercise an increase of from 82 to 300 per cent over the basal values. This corresponds to the increased energy consumption for rowing, walking, and bicycling at low speed. Running for a distance of from 300 to 1,000 meters caused an increase in energy consumption corresponding to that of rowing with maximum effort, amounting to from 320 to 950 per cent of the basal values.

A short method of calculating energy, protein, calcium, phosphorus, and iron in the diet, E. Hawley (*U. S. Dept. Agr., Tech. Bul. 105 (1929), pp. 20, figs. 5*).—The method described provides for the calculation of the energy, protein, calcium, phosphorus, and iron in the diet and is designed for foods as purchased.

In the development of the method 133 common foods were classified in 10 groups as follows: "(1) Foods that are relatively better sources of calcium than of protein, phosphorus, and iron; (2) foods in which all of the nutrients are of about the same relative importance; (3) foods in which iron is of relatively more importance than the other three nutrients; (4) foods in which calcium is relatively low and the other three nutrients high; (5) foods that are lacking or practically lacking in the four nutrients; (6) animal foods in which calcium is relatively low, protein high, and phosphorus and iron intermediate; (7) foods in which calcium is relatively high, iron low, and protein and phosphorus intermediate; (8) foods in which protein and phosphorus are relatively high and calcium and iron low; (9) vegetable foods in which calcium is relatively low, protein high, and phosphorus and iron intermediate; and (10) foods in which protein is relatively higher than the other three nutrients."

Nutritive values were then assigned to each group in terms of calorie pounds and protein-mineral pounds, and for each food two factors were calculated for use in finding the number of calorie pounds and protein-mineral pounds yielded by the various foods making up the dietaries to be studied. A sample dietary is given showing how the method is used, and data are included and discussed on its accuracy.

From a study made with 121 food records it was found that the method on the whole gave results within 5 per cent of those obtained by the long method, and that in calculating the nutritive value of a varied diet agreement with the long method may be expected within 7 per cent for energy and 10 per cent for protein, calcium, phosphorus, and iron. Comparison of the time required for calculating dietaries by the short cut method with that by the long method as shown by the calculation of 36 dietaries by five workers gave an average time saved by the short-cut method of 42 per cent of the time necessary for the long calculation.

Making bread from Wyoming flour, E. J. McKittrick and E. G. Grundmeier (*Wyoming Sta. Bul. 162 (1929), pp. 53–76, figs. 2*).—In this complete report of the baking studies carried on with Wyoming hard wheat flours, data are given on the absorption power, the percentages of wet and dry gluten, and crude protein of five varieties of Wyoming hard wheat flour and the alterations in formulas necessary to make good bread from these flours.

As was noted in the preliminary report (E. S. R., 60, p. 789), the chief difficulty encountered was in preventing the development of cracks in the loaf on baking. This was done by increasing the humidity in the proofing chamber and oven. The high altitude, 7,159 ft., made it necessary also to use rather high baking temperatures, from 410 to 425° F., for 35 minutes. The most satisfactory formula is given, with directions for manipulation.

[Studies in human nutrition] (*New Hampshire Sta. Bul. 238 (1929), pp. 11, 12, fig. 1*).—Oxycalorimeter combustions and Kjeldahl determinations have been made by A. G. Farr, in cooperation with F. G. Benedict, on 470 samples of meal combinations and foods available for purchase at restaurants, the university cafeteria, drug stores, and creameries in the vicinity of the station.

Twenty-one consecutive meals served by the resident students living at the home economics practice house were analyzed and found to average 2,450 calories and 61 gm. of protein per person per day. Chocolate-coated coconut candies, chocolate-coated bars with cream centers, and chocolate and nut bars were found to have a distinct calorie value. One pint of chocolate milk shake made by the college creamery furnished 448 calories and 14 gm. of protein.

Vitamin investigations (*Georgia Sta. Rpt. 1928, pp. 33, 34*).—In this progress report (E. S. R., 59, p. 293) data are given on the vitamin content of various Georgia foods. Three gm. daily of Hearts of Gold cantaloupe proved to be the minimum protective dose against scurvy, and 0.2 gm. of the same variety as a source of vitamin A sufficed to produce the standard gain of 25 gm. in an 8-week test period. Of turnip greens 0.3 gm. of the raw material protected against scurvy. Boiling the greens for 45 minutes with all of the water cooked back caused a loss of about 85 per cent in vitamin C potency. Only 0.02 gm. of the greens raw or cooked was required as a source of vitamin A for the 25-gm. gain in 8 weeks.

"Red" copper makes possible red hemoglobin in the blood (*Wisconsin Sta. Bul. 405 (1929), pp. 38–41, fig. 1*).—Essentially noted from another source (E. S. R., 59, p. 893).

Diet proteins and vitamins as related to hemoglobin production in the rat, G. F. Cartland and F. C. Koch (*Amer. Jour. Physiol., 87 (1928), No. 1, pp. 249–261, figs. 4*).—This is the complete report with experimental data of the investigation noted from a preliminary report (E. S. R., 59, p. 292).

The vitamin content of some common fruits and vegetables (*Kansas Sta. Bien. Rpt. 1927–28, pp. 123, 124*).—In this progress report (E. S. R., 56, p. 894) it is stated that raw Kieffer pears contain about 12 units (Sherman) of vitamin B per ounce, which is about the same amount as in lettuce. Early Richmond cherries canned by the open-kettle method contained about 9 units and yellow Elberta and white peaches canned by the open-kettle and cold-pack methods about 6 units per ounce.

Fresh Kieffer pears contained more than 2 units per ounce of vitamin C, this amount being somewhat higher than the figures usually given for fresh apples. The canned fruits were very low in vitamin C. Elberta peaches canned by the cold-pack method contained only about 1 unit, and Kieffer pears canned in the same way less than 1 unit per ounce.

Studies in the physiology of vitamins.—VI, The effect of insulin on gastric motility in vitamin B deficiency, C. J. Stucky, W. B. Rose, and G. R. Cowgill (*Amer. Jour. Physiol., 87 (1928), No. 1, pp. 85–92, fig. 1*).—To determine whether or not the hyperglycemia reported as occurring in vitamin B deficiency is related to the disturbances in gastric motility noted in a previous paper of the series (E. S. R., 56, p. 795), tracings of the gastric motility of seven dogs with simple gastric fistulas were taken at frequent intervals during the progress of and recovery from B-avitaminosis. Blood sugar determinations were made at frequent intervals.

In most of the animals a decrease in gastric motility developed on the B-deficient diet. At this point insulin was injected and the effects on gastric motility observed. In 6 of the 8 cases studied (1 of the dogs being used in 2 series of experiments) there was a progressive decrease in gastric motility, while in the other 2 the contractions remained vigorous throughout. Of the 16 insulin experiments performed on the dogs showing a decrease in gastric motility, 4 showed definite improvement in motility following the insulin treatment.

Since insulin had been found by one of the authors to contain no appreciable amout of vitamin B, this favorable response in a few cases could not be attributed to the presence of vitamin B. No direct relationship between blood sugar level and gastric motility could be demonstrated.

The anti-scorbutic vitamin in cabbage soup, cabbage puree, and turnip juice, E. Tso (*Chinese Jour. Physiol., 2 (1928), No. 4, pp. 403–408*).—In an attempt to find inexpensive sources of vitamin C for infant feeding in northern

China, the author has tested the possibility of utilizing the native cabbage (*Brassica pekinensis*) and Chinese winter turnip (*Raphanus sativus*) in the form of soup, puree, or juice. The cabbage soup was prepared by cooking shredded cabbage with an equal weight of tap water for 15 minutes' actual boiling time, cooling, straining, and adding table salt to taste. The puree was prepared by cooking shredded cabbage for 15 or 20 minutes in as little water as possible and rubbing the material through a sieve. Turnip juice was prepared by grating the entire root, including the skin, and straining it through cloth.

In the feeding experiments, guinea pigs weighing from 240 to 350 gm. were fed a basal diet of soybean meal 30, mung bean flour 30, millet meal 30, sodium chloride 1, calcium carbonate 2, and cod-liver oil 2 parts, the ingredients being made into a semisolid paste by cooking for from 30 to 40 minutes with water in a double boiler. On this diet death from scurvy is said to take place invariably within 4 weeks. From 2 to 3 animals were used for each amount of the materials tested. The minimum amounts for protection against scurvy and normal growth during an experimental period of 5 months were 30 cc. daily of cabbage soup, from 5 to 10 gm. of cabbage puree, and 20 cc. of turnip juice, respectively.

Growth and reproduction of rats on vitamin C free diet, E. Tso (*Soc. Expt. Biol. and Med. Proc., 26 (1929), No. 4, pp. 276, 277*).—A brief preliminary report is given of an investigation of the question of the need of rats for vitamin C. Rats were carried into the third generation on the vitamin C-free diet described above. A group of third-generation animals was continued on this diet and another given, in addition, a vitamin C supplement of 2 gm. daily per rat of fresh Chinese cabbage.

At the age of 8 months the weights of the animals on the two diets were not significantly different. The average weights of four males each on the basal and vitamin C diets were 314 and 329 gm., respectively, and of the five females 234 and 261 gm., respectively. The basal ration rats raised two out of four litters and the cabbage-fed three out of four. Two females and two males were continued on the two diets. On the supplemented diet two litters were cast but not reared, and on the basal one small litter was successfully weaned.

These results are thought to indicate that vitamin C is unnecessary for rats.

Tests show homemade sauerkraut a source of vitamin C (*Wisconsin Sta. Bul. 405 (1929), p. 48*).—Fresh sauerkraut prepared under home conditions by allowing the cabbage to ferment for 90 days at a temperature of 60 to 65° F., but not pasteurizing or heating it, was found by B. Clow and A. L. Marlatt to contain about half as much vitamin C as fresh cabbage.

Ethylene gas increases vitamin content of tomatoes (*Wisconsin Sta. Bul. 405 (1929), pp. 48, 49, fig. 1*).—In addition to results noted in a previous progress report (E. S. R., 59, p. 94), ethylene-ripened tomatoes have been found by B. Clow, I. M. Stevenson, and A. L. Marlatt to be richer in vitamin C than green tomatoes, but not quite as potent as tomatoes thoroughly ripened by standing at room temperature until the tomato tissues are considerably softened.

It is also noted that ripe greenhouse tomatoes do not ordinarily contain as much vitamin C as field-ripened tomatoes on account of the fact that they are not as ripe when used, but if allowed to ripen thoroughly give comparable results. Green tomatoes ripened at 70° F. after picking appear to contain as much vitamin C as vine-ripened tomatoes.

The association of bowel disease with vitamin C deficiency, F. P. Mackie and G. D. Chitre (*Indian Jour. Med. Research, 16 (1928), No. 1, pp. 77–94, pls.*

4, figs. 2).—Monkeys fed a diet deficient in vitamin C became anemic, lost weight rapidly, and developed scurvy, generally accompanied by dysentery ending in death. The post-mortem signs were most marked in the large intestine, and varied from local congestion and thickening of the mucous membrane to a condition indistinguishable from ulcerating and sloughing dysentery. Dysentery bacilli were not found in the majority of cases, but in some instances the common fecal flora were found to have invaded the walls of the intestines. Some of the animals had been fed infected sprue material, but this appeared to make no difference in the changes appearing in the alimentary tract. It is concluded that the deficiency of vitamin C is a powerful predisposing cause of bowel derangements, acting probably by reducing the natural resistance of the intestinal epithelium to the invasion of bacteria or their toxins.

Household storage of eggs does not impair antirachitic value (*Wisconsin Sta. Bul. 405 (1929), p. 47*).—Supplementing a previous study (E. S. R., 59, p. 96), the effect of other storage methods on the antirachitic properties of eggs has been determined by B. Clow and A. L. Marlatt. The storage methods included cold storage (40° F.) in an electric refrigerator, dipping in hot fat (375°) for 5 seconds, and dipping in hot water (205°) for 5 seconds. The dipped eggs were stored in a regular egg box in the fruit and vegetable room in the basement of a farm residence.

None of these methods affected the vitamin D content of the eggs, but the dipping methods are not recommended for household practice on account of the change in physical consistency of the eggs during storage.

The irradiation of sterols: The relation of irradiated sterols to antirachitic vitamin [trans. title], R. FABRE and H. SIMONNET (*Jour. Pharm. et Chim., 8. ser., 8 (1928), No. 11, pp. 480–506, pl. 1, fig. 1*).—A comparison of the changes in the absorption spectra of cholesterol and ergosterol during ultraviolet irradiation with corresponding biological changes as shown by the effect of the materials in the prevention of rickets in rats has shown that the photochemical transformation is not arrested at the biologically active stage of the product. The optical density gradually diminished in the zone of 2,700 to 3,000 angstrom units.

Irradiating food products on commercial scale proves feasible (*Wisconsin Sta. Bul. 405 (1929), pp. 37, 38, figs. 2*).—Rolled oats irradiated on an industrial scale by H. Steenbock, R. C. Thomas, and W. P. Elmslie have been found capable of preventing rickets in dogs and rats.

The utilization of Jerusalem artichokes by a patient with diabetes, T. M. CARPENTER and H. F. ROOT (*Arch. Int. Med., 42 (1928), No. 1, pp. 64–73*).—The gaseous exchange, absorption of food, and composition of the blood and urine of a diabetic patient were determined for 6 days, during 5 of which Jerusalem-artichokes provided more than 100 gm. of the carbohydrates and supplied about 95 per cent of the hydrolyzable sugars. On 1 day the artichokes were replaced with baked potatoes containing an equivalent amount of carbohydrates.

Analyses of composites of the food ingested for 4 days showed an average daily intake of 76 gm. of protein and 271 gm. of dry nitrogen-free and fat-free substances. The average daily absorption as determined by the analyses of the feces for the 6 days was protein 50, fat 40, and carbohydrate 205 gm., with a total energy content of about 1,500 calories. The calculated heat production for 4 days gave minimum values of from 1,450 to 1,550 calories per 24 hours, 50 per cent of which came from carbohydrates, from 32 to 36 per cent from fat, and from 16 to 21 per cent from protein. The average basal respiratory quotient was 0.84. The ingestion of food produced a rise to 0.91 in the respiratory quotient and a maximum increase in the oxygen consumption of 14 per cent.

The patient was sugar-free during the time in which artichokes furnished the greater portion of the carbohydrates, but the substitution of baked potatoes for the artichokes on 1 day was accompanied by an increased excretion of urinary nitrogen, the prompt appearance of sugar in the urine, a rise in the blood sugar, and an increase in the heat production. All of these values were lowered on the following day when the artichokes took the place of the baked potatoes.

These results show that, as previously suggested by Root and Baker (E. S. R., 54, p. 894), Jerusalem-artichokes furnish carbohydrates which can be absorbed and utilized by diabetic patients.

TEXTILES AND CLOTHING

The protective value of certain clothing fabrics (*Kansas Sta. Bien. Rpt. 1927–28, pp. 125, 126*).—In this progress report (E. S. R., 57, p. 199) data are given on the protective values of blue flannel (wool) and Canton flannel (cotton) in still and moving air. The blue flannel showed at all air velocities from 0 to 13.2 miles per hour greater protection than the Canton flannel.

HOME MANAGEMENT AND EQUIPMENT

The use of time in farm homes, J. O. Rankin (*Nebraska Sta. Bul. 230 (1928), pp. 50, figs. 19*).—This bulletin is based chiefly upon material obtained in a survey made in 1924, in cooperation with the U. S. D. A. Bureau of Agricultural Economics (E. S. R., 57, p. 685), of 342 unselected farm homes in 4 representative farming areas of Nebraska. The data so obtained are supplemented by data obtained from a questionnaire filled in in 1929 by 343 crop reporters' wives scattered throughout the State and by data on musical instruments and community library facilities obtained in a survey made of 3,449 farm club women's homes by home demonstration agents in 1926 under the auspices of the General Federation of Women's Clubs.

Tables and graphs are given and discussed showing for home makers and operators the number of hours of daily work and recreation, the percentage reporting and the yearly number of away-from-home activities of different kinds, and the percentage taking vacations and the number of days per year taken. Other tables show the percentage of home makers doing indoor and outdoor work of different sorts; the percentage of families employing hired men, hired girls, and extra help and boarding such help with the number of days or weeks board was furnished; the percentage of homes having visitors and the number of and time spent in homes by such visitors; the percentage of families having sickness and invalids and the number of persons sick, aged, or invalided per family; the percentage of farm homes having communication and recreational facilities with comparison with village and city homes of the State; the percentage of farm homes taking papers and magazines of different sorts; the total and specified educational and recreational costs per farm family grouped according to total annual expenditures and showing the percentage of living costs so expended, and comparison of amount and percentage of total and specified educational and recreational costs per year of Nebraska farm homes and of 3,828 urban homes in the north-central division of the United States and 12,094 homes in 92 cities of the United States; and the percentage of operators and home makers belonging to organizations of different sorts.

Other tables and graphs show for children in the Nebraska farm families studied, by sex and different age groups, the percentage doing different kinds of farm and house work and work away from home, the percentage engaging in play and recreation of different kinds, the percentage doing home reading and

lessons of different kinds, and the percentage belonging to one or more clubs and to different types of clubs.

MISCELLANEOUS

The Forty-first Annual Report of the Colorado Agricultural Experiment Station for the year 1928, C. P. GILLETTE ET AL. (*Colorado Sta. Rpt. 1928, pp. 48*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1928, a report of the director on the work of the station, and departmental reports. The experimental work reported is for the most part abstracted elsewhere in this issue.

[Thirty-eighth and Thirty-ninth Annual Reports of Connecticut Storrs Station, 1926–1927] (*Connecticut Storrs Sta. Rpts. 1926, pp. IV+290, pls. 18, figs. 67; 1927, pp. IV+340, figs. 70*).—These reports contain, respectively, reprints of Bulletins 137–143 and 144–149, all of which have been previously noted.

Forty-first Annual Report [of Georgia Station], 1928, H. P. STUCKEY (*Georgia Sta. Rpt. 1928, pp. 43, figs. 5*).—This contains the organization list, a report by the director of the station on its work during the year, and a financial statement for the fiscal year ended June 30, 1928. The experimental work reported is for the most part abstracted elsewhere in this issue.

[Report of Kansas Station, 1927–1928], L. E. CALL (*Kansas Sta. Bien. Rpt. 1927–28, pp. 153, figs. 4*).—This contains the organization list, financial statements for the biennium ended June 30, 1928, and a report of the director summarizing the work and publications of the station. The experimental work recorded not previously noted is for the most part abstracted elsewhere in this issue.

Agricultural experiments, 1928: Annual report of the director of the New Hampshire Agricultural Experiment Station, [J. C. KENDALL] (*New Hampshire Sta. Bul. 238 (1929), pp. 35, figs. 8*).—This contains the organization list, a report of the director on the work of the station, and a financial statement for the fiscal year ended June 30, 1928. The experimental work reported is for the most part abstracted elsewhere in this issue.

Forty-first Annual Report [of Tennessee Station], 1928, C. A. MOOERS ET AL. (*Tennessee Sta. Rpt. 1928, pp. 56, figs. 66*).—This contains the organization list, an account of the work of the station, and a financial statement as to the Federal funds for the fiscal year ended June 30, 1928. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

What's new in farm science: Annual report of the director, [Wisconsin Station, 1928], compiled by N. CLARK (*Wisconsin Sta. Bul. 405 (1929), pp. 128, figs. 49*).—This contains the organization list, an account of the activities of the station, a list of the station publications of the year, and a financial statement as to the Federal funds for the year ended June 30, 1928. The experimental features not previously reported are for the most part abstracted elsewhere in this issue.

NOTES

Alabama College and Station.—Dr. F. W. Parker, associate professor of agronomy and soils chemist, resigned July 1 to engage in commercial work.

Florida Station.—Dr. R. V. Allison, soils specialist at the Everglades Substation, has been placed in charge of that substation, effective July 15. Plans for its research work include the replacement of the positions in plant pathology and agronomy vacated after the hurricane of 1928. The new positions to be filled include a chemist, an entomologist, and a laboratory assistant in soils.

Recent appointments include Dr. W. M. Neal as assistant in animal nutrition, effective June 15; Dr. Arthur L. Stahl as assistant horticulturist, effective July 1; and Randall R. Kincaid as assistant plant pathologist at the Tobacco Substation.

Georgia Station.—The station recently cooperated with the county agent and home demonstration agent of the county and a local banking company in a contest designed to bring the work of the station to the attention of farm families of the vicinity. Five prizes were offered to young people for the best essay or story on the subject of What the Georgia Experiment Station Means to Our State. The boys and girls were divided into two classes, those from 16 to 21 years and those under 16 years of age. In each class five prizes were given, consisting, respectively, of a purebred Jersey calf, a purebred Poland-China pig, six Hunt muscadine grapevines, six Young dewberry plants, and two blight-resistant Pineapple pear trees. These prizes were all products, introductions, or originations of the station, and were purchased by the banking company and donated to the contest. The contestants registered at the county picnic on July 26, and were conducted over the station at the time.

Hawaii University and Station.—The Territorial legislature has appropriated $5,000 for a research station in the Kona coffee district of the island of Hawaii. This will be operated in connection with the main station, which is now conducted jointly by the U. S. Department of Agriculture and the university.

In spite of the rigid quarantine which prevents exportation of the fruit to the mainland because of the Mediterranean fruit fly, avocado growing in Hawaii is rapidly being extended. The station is accordingly endeavoring to develop various by-products and new means of processing the avocado in order to provide a broader market. Elizabeth Harrold has been appointed to carry on chemical studies of this problem.

Otis W. Barrett has been appointed professor of horticulture in the university.

Idaho University and Station.—The station department of agricultural economics is to cooperate with the U. S. Department of Agriculture and the Washington Station in a study of the changes in farm organization and farm management in northern Idaho and eastern Washington. This will involve an investigation of new types of machinery and the influence of these new factors on profits. Dr. Paul A. Eke, assistant professor of farm economics and assistant farm economist in the West Virginia University and Station, has been appointed agricultural economist and has entered upon his duties.

For the first time in the history of the State the soil survey will be cooperative with the School of Forestry of the university as well as with the U. S. D. A. Bureau of Chemistry and Soils. One of the surveys this summer is being conducted in Benewah County, and includes both the soils and the forest resources with the purpose of differentiating between those lands well adapted to farming and those that probably should be devoted permanently to forestry. Deep tillage studies will also be initiated in three new sections to determine the effect of deep tillage processes on the moisture-holding capacity of soils and subsequently upon crop production.

In agricultural engineering a study is to be made of a number of wells of large capacity as to their influence on the water table and their efficiency in supplying water for irrigation. Other irrigation studies are to be carried on with sugar beets, potatoes, and beans.

The poultry department has been working with methods for raising baby chicks under strictly sanitary conditions. Chicks have been grown to more than six weeks of age without touching the ground. Net devices for giving the chicks contact with the open air and sunshine but not with the soil, as well as drinking fountains and feed equipment to promote sanitation, are being developed. In addition attention is being given to the possibility of substituting the protein of pea meal for the various animal proteins.

L. D. Raeder, assistant field agronomist in the extension division, has resigned to engage in commercial work.

Iowa College and Station.—The first building to be erected at the college and also in the town of Ames has just been demolished. This was the cattle barn built in 1861, and used at one time as an assembling center for an Iowa company of troops during the Civil War.

Fred L. Garlock, assistant professor of agricultural economics in the college and assistant in agricultural economics in the station, has resigned to accept an appointment as senior research specialist in short-term finance and intermediate credit in the U. S. D. A. Bureau of Agricultural Economics.

Kentucky University and Station.—The most comprehensive building program in the history of the institution is now under way. In February a new recitation building which was named in honor of President F. L. McVey was opened and in June Memorial Hall, erected in honor of Kentucky's war dead and to be used as a chapel and convocation hall, was dedicated with fitting ceremonies. Other buildings under way are two additional dormitories for men; a teacher's training building, financed equally by the General Education Board and the State; a greenhouse, especially built for laboratory work of students in heating and ventilating engineering and the gift of an alumnus, Percy Johnston of New York City; a dairy products building on the station farm, to be completed during the summer; and the first unit of a university library building to cost about $1,000,000, for which ground was broken in June.

Effective July 1, Dr. A. M. Peter, chemist, and Dr. Harrison Garman, head of the department of entomology and botany, retired, having reached the retirement age of 70 years. Mariel Hopkins, head of the department of home economics, and Lula M. Hale, field agent at the Robinson Substation, have resigned. D. J. Healy, research bacteriologist, has been transferred from the department of chemistry to that of animal pathology. Recent appointments include Statie E. Erikson as head of the department of home economics, Dr. H. B. Price as head of the department of markets and rural finance, Harvey F. Cunov as assistant bacteriologist in the department of public service laboratories, and Genevieve M. Farwell as assistant in the department of animal pathology. Dr. W. D. Valleau, professor of plant pathology and plant pathologist in the de-

partment of agriculture, has also been appointed horticulturist in the department of horticulture.

Maryland University.—Construction of a new library building will soon be begun. Plans are also under way for a new horticultural building, a central heating plant, a girl's dormitory, and an addition to the engineering college building.

Dr. L. B. Broughton, professor of agriculture and food chemist, has been appointed head of the department of chemistry and State chemist.

Massachusetts College.—The honorary degree of doctor of science was awarded by the college at its recent commencement to Charles S. Plumb, head of the department of animal husbandry at the Ohio State University. Marion G. Pulley, instructor in poultry husbandry, has resigned.

Michigan College and Station.—Jean Krueger, dean of home economics, and Elizabeth Bemis, supervisor of nutritional management, have resigned, effective September 1, to engage in commercial work. J. B. Edmond has resigned as research assistant in horticulture, effective August 1. R. C. Cole has been appointed research assistant in soils, effective July 1, vice G. R. Schlubatis resigned. Dr. M. W. Emmel has been appointed research assistant in bacteriology to devote his time to work with poultry diseases.

Montana Station.—Arnold H. Johnson, assistant chemist, has resigned to accept a position as research chemist with a dairy research foundation in Baltimore, Md., and will be succeeded on September 1 by Dr. William McKinley Martin. Erlene Jacobs, assistant in home economics, has also resigned, effective September 1, and will be succeeded by Dorothy Douglas.

Nevada University and Station.—A gift of about $500,000 has been made by Clarence H. Mackay to build and equip the Mackay Science School. The gift is in memory of Mr. Mackay's father, the late John W. Mackay, and supplements a series of gifts to the university by the family since 1908, chiefly to the Mackay School of Mines.

Karl William Niemann has been appointed assistant research professor of veterinary science in the station, beginning July 1.

Porto Rico Station.—A special deficiency appropriation has enabled the station to rebuild the various structures damaged or destroyed by the hurricane of September 13, 1928.

Rhode Island College.—The degree of doctor of agriculture was conferred by the college at its recent commencement on Dean A. R. Mann of Cornell University.

Tennessee Station.—Philips B. Boyer has been appointed assistant agricultural economist and will devote full time to research in rural sociology and rural economics.

Utah Station.—Dr. D. E. Madsen, assistant in pathological investigations in the Pennsylvania State laboratories, has been appointed animal pathologist in the station and will have charge of the new animal disease laboratory being established on the college campus under the provisions of the act of the last legislature, which appropriated $10,000 to build a laboratory.

Vermont University and Station.—A building approximately a century and a quarter old has been renovated for use by the agronomy department of the College of Agriculture and the agronomist of the station. Dr. A. R. Midgley has been appointed agronomist of the station.

EXPERIMENT STATION RECORD

VOL. 61 AUGUST ABSTRACT NUMBER No. 3

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

The amino-acid methionine: Constitution and synthesis, G. BARGER and F. P. COYNE (*Biochem. Jour., 22 (1928), No. 6, pp. 1417–1425*).—Originally discovered as the result of a bacteriological investigation by Mueller of the hydrolysis products of casein (E. S. R., 47, p. 584) and later shown by the same investigator (E. S. R., 49, p. 714) to have the empirical formula $C_5H_{11}O_2NS$, the amino acid named by the authors of the present contribution "methionine" has remained heretofore of unknown constitution.

By the synthesis of a racemic derivative identical in every respect, except in regard to its optical activity, with the amino acid isolated from casein, gelatin, and from some other proteins, it has now been shown that Mueller's amino acid is γ-methylthiol-α-aminobutyric acid, to which constitution allusion is made in the abbreviated designation suggested.

The experimental work described consisted first in the isolation of methionine from the products of the hydrolysis of gelatin with hydrochloric acid, the new amino acid appearing among the substances precipitable by Hopkins's mercuric sulfate reagent (10 per cent mercuric sulfate in 5 per cent sulfuric acid); second, a determination of methylthiol which indicated the presence of one $CH_3.S$- group in the molecule; and third, a synthesis of methionine involving the following steps: β-Methylthiolpropaldehydediethylacetal, β-methylthiolpropaldehyde, α-amino-γ-methylthiolbutyronitrile, and α-amino-γ-methylthiolbutyric acid.

Certain derivatives of methionine, prepared both from the natural and from the synthetic product, were compared and found identical. The most satisfactory identifications were obtained with the thiohydantoins and picrolonates of the methionines from two sources, the first-named of the derivatives melting at 146° C. both individually and in mixture, whereas the picrolonates melted at 178° individually and at 177 to 178° in mixture. The syntheses of some other compounds more or less closely related to methionine and of possible use in its synthesis are also described.

Resolution of *dl*-thyroxine, C. R. HARINGTON (*Biochem. Jour., 22 (1928), No. 6, pp. 1429–1435*).—Noting that racemization is to be expected as a result of the hydrolysis by means of alkalies necessary in all methods at present known to be applicable for the isolation of thyroxine from the thyroid gland, with the consequence that the product designated "natural" thyroxine is the *d-l-* compound, the author suggests that "should the naturally occurring variety of thyroxine be considerably more active physiologically than its isomeride, an explanation of the discrepancy observed by certain workers . . . between the

physiological activity of thyroxine and of amounts of thyroid gland containing equivalent quantities of iodine, would be afforded by the fact that the thyroxine had been artificially racemized, for in the process of racemization the thyroxine might lose anything up to one-half of its physiological activity, depending on the relationship between the activities of the two isomerides." The author then proceeds to describe the preparation both of *d*- and of *l*- rotatory thyroxine by crystallization of the salts of formyl-*dl*-3 : 5-diiodothyronine with *d*-α-phenylethylamine and with *l*-α-phenylethylamine, respectively, the formyl group having been removed by hydrolysis with hydrobromic acid and the two additional items necessary to convert the diiodothyroxines into the corresponding thyroxines introduced after the resolution of the optical isomers.

The *l*-thyroxine thus prepared had the specific rotation

$$[\alpha]^{21°}_{5461} = -3.2°$$

and the *d*-compound gave the value

$$[\alpha]^{21°}_{5461} = +2.97°.$$

A supplementary note by J. H. Gaddum describes briefly tests of the comparative physiological properties of the two forms of thyroxine as applied to tadpoles and to rats. In the last-named set of experiments the conclusion was reached that "the *l*-thyroxine appears to be about three times as potent as the *d*-thyroxine."

Some derivatives of thyroxine, J. N. Ashley and C. R. Harington (*Biochem. Jour., 22 (1928), No. 6, pp. 1436–1445*).—The preparation,, analyses, and some other chemical characteristics and physical properties of the following compounds, derived from thyroxine or related to that substance, are described: 3 : 5-diiodothyronine methyl ester hydrochloride; 3 : 5-diiodothyronine methyl ester; chloroacetyl-3 : 5-diiodothyronine methyl ester; chloroacetyl-3 : 5-diiodothyronine; glycyl-3 : 5-diiodothyronine; glycylthyroxine; α-bromopropionyl-3 : 5-diiodothyronine methyl ester; α-bromopropionyl-3 : 5-diiodothyronine; *dl*-alanyl-3 : 5-diiodothyronine; thyroxine methyl ester hydrochloride; thyroxine methyl ester; chloroacetylthyroxine methyl ester; chloroacetylthyroxine; glycylthyroxine; α-bromopropionylthyroxine methyl ester; α-bromopropionylthyroxine; alanylthyroxine; N-acetyllactylthyroxine methyl ester; N-lactylthyroxine; 3 : 5-diiodothyronamine; and thyroxamine.

A contribution concerning pine wood lignin [trans. title], E. Hägglund and H. Urban (*Biochem. Ztschr., 207 (1929), No. 1–3, pp. 1–7*).—By means of a short treatment of pine wood (from which the resin had been removed) with very concentrated hydrochloric acid, the authors obtained lignin preparations still containing considerable quantities of carbohydrates soluble in boiling solutions of a concentration of from 4 to 5 per cent of inorganic acids. These carbohydrates soluble in boiling dilute acids could be extracted without damage to the material in from one to two days' treatment. Carrying the hydrolysis with dilute acids still further, with intermittent washing out, the authors observed a slow increase, unaccompanied by any significant further loss of substance, of the methoxyl content of the preparation up to 17 per cent, the formaldehyde separable by the Tollens method decreasing meanwhile to about 0.4 per cent. Ligninsulfonic acid preparations yielded, when subjected to the Tollens distillation, substances capable of condensing with barbituric acid in quantities varying with the method of preparation. Amyl and propyl lignins, prepared either from wood or from lignin isolated by means of hydrochloric acid, yielded practically no formaldehyde in the Tollens distillation, acetyl lignins behaving similarly.

It was further found that under the conditions of the lignin preparation piperonylic acid yielded formaldehyde neither with amyl alcohol nor with glacial acetic acid, while formaldehyde, under the conditions of the amyl alcohol treatment, became converted into diamylmethylal. Some further properties of the lignin preparations and of substances derivable from them are detailed.

A microapparatus for the measurement of the conductivities of very small volumes of liquids [trans. title], I. Remesow (*Biochem. Ztschr.*, 207 (*1929*), *No. 1–3, pp. 66–79, figs. 7*).—The apparatus described and illustrated, including both a microconductivity cell protected against variations in temperature and a set-up for the electrical measurements, is said to have permitted conductivity measurements at an absolutely constant temperature in samples as small as 0.05 cc. with an accuracy of from 0.1 to 0.5 per cent.

The influence of manganiferous soils on the accuracy of the quinhydrone electrode, W. T. McGeorge (*Soil Sci.*, 27 (*1929*), *No. 2, pp. 83–88, fig. 1*).—Using a quinhydrone electrode system consisting of a special half cell having the electrolyte 0.01 N hydrochloric acid, 0.09 N potassium chloride connected through a saturated potassium chloride solution and a potassium chloride-agar bridge to the quinhydrone saturated soil suspension, the author of this communication from the Hawaiian Sugar Planters' Experiment Station made determinations 1 : 1, 1 : 3, and 1 : 5 suspensions of 22 soil types, brief descriptions of which are given, at the same time securing the hydrogen electrode potentials of the same preparations. In the cases of 21 of these 22 soils the manganese content as Mn_3O_4 is tabulated, with the pH values as calculated from the two sets of electrode data.

Quinhydrone electrode potentials were determined also in suspensions of soils in the presence of 0.2 and of 0.5 gm. of added manganese dioxide, the larger of these additions causing a maximum increase in potential of 170 millivolts (from 130 to 300), according to the tabulated potentiometer readings covering these experiments. Similarly tested for interfering effect, ferric oxide and hydrated oxide had no effect on the potentiometer readings.

"By reference to the description of the soils, it will also be noted that in all cases where lack of agreement was found the soil was a red clay type. Such types we consider to have been formed in a more arid environment . . . and therefore contain iron and manganese as the higher oxides. Manganese is present in such types in the form of small pellets of MnO_2 or as a coating of MnO_2 upon the surface of the soil particles. The evidence is therefore quite convincing that MnO_2 materially disturbs the equilibrium of the dissociation products of quinhydrone."

In conclusion it is further stated that "the accuracy of the quinhydrone for the determination of soil reaction is greatly affected by the presence of small amounts of manganese dioxide. It is not the purpose of this article to condemn the use of the quinhydrone electrode for soil analyses. The drift . . . with manganiferous soils is sufficiently rapid and characteristic . . . to warn the analyst against reporting erroneous results on such types."

A rapid electrometric method for measuring "lime requirements" of soils, F. Hardy and A. H. Lewis (*Jour. Agr. Sci. [England]*, 19 (*1929*), *No. 1, pp. 17–25*).—The method found most satisfactory consisted in first developing "exchange acidity" by the treatment of the soil sample with a solution of calcium chloride and then titrating the mixture directly with a dilute standardised solution of calcium hydroxide to a pH value of 7.0, with the quinhydrone electrode as indicator. It is carried out as follows:

Mix in a small wide-mouthed bottle 10 gm. of the soil with 40 cc. of neutral 0.2 molar calcium chloride solution. Titrate the mixture with successive por-

tions, 5 cc. each, of 0.03 N calcium hydroxide solution, shaking for 3 minutes following each addition, and determining the pH value. Plot the results and estimate the exact volume requirement of the calcium hydroxide solution for the adjustment of the soil suspension to PH 7.0 by means of the graph.

The principal effects of the addition of calcium carbonate to an acid soil are discussed under the heads (1) the effect of the calicum ion, (2) the effect of the bicarbonate ion, and (3) the effect of the hydroxyl ion.

"It is evident that the correction of an acid soil condition by liming invoices cationic and anionic exchange processes, as well as a true neutralization process. Hence, for any lime requirement method to be satisfactory it must also involve and reproduce similar processes."

The effect of lecithin in dairy products upon butter fat determinations, O. W. Chapman (*Jour. Dairy Sci., 11 (1928), No. 6, pp. 429–435*).—At the Iowa Experiment Station weighed amounts of lecithin prepared from egg yolks were added to buttermilk. Fat determinations were made on the buttermilk alone and on the buttermilk after the addition of lecithin. Three methods of testing were used: (1) Babcock, with skim milk test bottles; (2) butyl alcohol modification of the Babcock, with skim milk bottles; and (3) the Mojonnier test. The fat determinations showed that with the first method 71 per cent of the added lecithin affected the results, with the second method 68.5 per cent, and with the third method 76.5 per cent. Chemical analysis of samples of milk or cream showed that lecithin could be extracted in amounts great enough to cause considerable error in the fat determination of skim milk or buttermilk.

These results led the author to conclude that lecithin is present in amounts large enough to give results in the determination of fat which are appreciably high. This increase was approximately the same with the three methods of testing used. Correction of the fat determination indicated that the average fat loss in buttermilk is 0.57 per cent rather than 0.7 per cent.

A new reagent for the qualitative and quantitative nephelometric determination of quinine [trans. title], E. J. Sterkin and J. I. Helfgat (*Biochem. Ztschr., 207 (1929), No. 1–3, pp. 8–24*).—The potassium mercuric iodide alkaloid reagent proving unsuitable for the nephelometric determination of quinine by reason of the instability and nonreproducible character of the precipitate, an arsenomolybdate reagent was prepared by mixing equal volumes of a 0.12 per cent solution of sodium arsenate, a 2 per cent ammonium molybdate solution, and a 2 per cent solution of hydrochloric acid. This reagent was found fivefold more sensitive than any of the 10 alkaloid precipitants with which it was compared, an opalescence having been produced by it with a 1:2,000,000 solution of quinine hydrochloride.

The degrees of sensitiveness of the test for other alkaloids and for caffein are stated to be as follows: Apomorphine 1 part in 300,000, morphine 1 part in 6,000, cocaine 1 part in 300,000, atropine 1 part in 40,000, plasmochin 1 part in 100,000, and caffein 1 part in 200,000.

The reagent was optically clear in the nephelometer and was permanent for 1 month when exposed to light, or for from 4 to 5 months when kept in the dark.

METEOROLOGY

Physics of the air, W. J. Humphreys (*New York and London: McGraw-Hill Book Co., 1929, 2. ed., rev. and enl., pp. XII+654, pls. 2, figs. 225*).—In this second edition, this standard work (E. S. R., 44, p. 617) has been enlarged and thoroughly revised and brought up to date. "An additional part, meteorological acoustics, has been included, and many paragraphs and topics have been added.

Nothing in the older work has been discarded, though various portions have been rewritten and rearranged. For the convenience of the special student, references are given to important original sources."

Average rainfall tables for northern New England, G. RICHARDS (*Jour. New England Water Works Assoc., 43 (1929), No. 1, pp. 50–55*).—The numerical data on which were based the maps and discussion presented in a previous article (E. S. R., 60, p. 506) are given in tables.

The climate of Colorado: A forty-one year record, R. E. TRIMBLE (*Colorado Sta. Bul. 340 (1928), pp. 68*).—Observations on temperature of the air and soil, radiation, atmospheric pressure, precipitation, humidity, evaporation, and wind at Fort Collins, 1887–1927; for shorter periods on temperature and precipitation at Rocky Ford, Cheyenne Wells, and Long's Peak; and on precipitation at various other places in the State, including records of the Weather Bureau office at Denver, 1870–1927, are summarized in tables, with a brief general discussion of the more important climatic characteristics of the State. Characteristic features of the climate are low precipitation and high evaporation.

"At the experiment station, the average rainfall for 45 years' record is 15.03 in. Fortunately for the growing of agricultural crops and range for pasturing livestock, 11.86 of the 15.03 in. fall from March 1 to September 30, which amount is directly available for most crops grown. Of the other 3.17 in., 1.16 in. during the month of October usually fall as rain, and while not directly usable by crops in growth, it is of great value in preparing the ground for harvesting and putting it in better condition for the winter wheat, the orchards, and ranges. The remaining 2.01 in. fall almost entirely as snow. Although not entirely dissipated on the lower areas, it is drifted and packed in the mountains, especially in the timber and on north slopes, for use of the farms the next summer in the form of irrigation water from the streams. . . . The rainfall of the State decreases from the Kansas State line to near the base of the mountains, where it increases westward to the crest. . . . There is a wide range in the driest and the wettest years. For the calendar year 1893 at Fort Collins, a total of only 7.11 in. was observed as our least annual rainfall. However, the driest 12 months was from June, 1924, to May 31, 1925, with a total of but 5.15 in. Our wettest year in the 45 years' record was 27.57 in. in 1923."

Conditions with reference to occurrence of killing frosts vary widely. "In some respect nearly every locality enjoys a climate of its own, due to the effect of mountain, plain, lake, and mesa; and this is especially true of frosts. Due to difference in topography, the past records of one place are not to be relied upon for localities not far distant. . . . The average date of frost at Fort Collins is May 10 to 15, and September 15 to 20. At Rocky Ford and Cheyenne Wells, the season is slightly longer." With elevations ranging from 3,500 to 14,000 ft., barometric pressure is low. At the experiment station, at an elevation of 5,000 ft., the normal annual barometric pressure is 24.99 in.

The climate of the Netherlands Indies, Vol. II, parts 1, 2 [trans. title], C. BRAAK (*K. Magnet. en Met. Observ. Batavia, Verhandel. 8, vol. 1, pt. 8 (1925), pp. II+499–528, pls. 2, figs. 2; Eng. summary, pp. 249–272*).—This continuation of contributions previously noted (E. S. R., 53, p. 812) gives the contents of volume 1 of the series and certain additions to the earlier chapters.

The climate of the Netttherlands Indies, Vol. II, parts 1, 2 [trans. title], C. BRAAK (*K. Magnet. en Met. Observ. Batavia, Verhandel. 8, vol. 2, pt. 1 (1925), pp. V+156, pls. 2, figs. 11, Eng. summary pp. 67; pt. 2 (1928), pp. VIII+157–399, pls. 12, figs. 60, Eng. summary pp. 69–185*).—In continuation of contributions noted above, these parts summarize observations on climatic conditions in Sumatra, and Java and Madura (Madoera), respectively.

SOILS—FERTILIZERS

The climatic factor in the genesis and classification of soils [trans. title], H. M. NAGANT (*Sci. Agr., 9 (1929), No. 5, pp. 321–334, fig. 1*).—This article reviews the work of various soil investigators, emphasizing the importance of the climatic as well as the geological factor in the genesis and classification of soils, with especial reference to the podzol type as occurring in the Province of Quebec and elsewhere.

[**Soil Survey Reports, 1923 Series**] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1923, Nos. 1, pp. 24, fig. 1, map 1; 2, pp. 25–56, fig. 1, map 1; 3, pp. 57–89, fig. 1, map 1; 9, pp. 247–269, fig. 1, map 1; 11, pp. 307–329, pls. 3, fig. 1, map 1; 14, pp. 401–439, pls. 4, fig. 1, maps 2; 15, pp. 441–484, fig. 1, map 1; 16, pp. 485–535, pls. 5, fig. 1, maps 2; 25, pp. 799–821, fig. 1, map 1*).—These reports have appeared in previous editions without serial numbers and have previously been noted as follows:

No. 1, Soil Survey of Clarke County, Iowa, by A. M. O'Neal and C. B. Boatwright (E. S. R., 55, p. 314); No. 2, Soil Survey of Camden and Currituck Counties, North Carolina, by S. O. Perkins et al. (E. S. R., 55, p. 216); No. 3, Soil Survey of Sampson County, North Carolina, by R. C. Jurney et al. (E. S. R., 55, p. 416); No. 9, Soil Survey of Mercer County, West Virginia, by A. W. Goke (E. S. R., 56, p. 418); No. 11, Soil Survey of Dickson County, Tennessee, by J. A. Kerr et al. (E. S. R., 56, p. 511); No. 14, Soil Survey of Lake County, Florida, by A. E. Taylor et al. (E. S. R., 56, p. 417); No. 15, Soil Survey of Kearney County, Nebraska, by M. H. Layton et al. (E. S. R., 56, p. 810); No. 16, Soil Survey of the Coachella Valley Area, California, by A. E. Kocher and W. G. Harper (E. S. R., 57, p. 15); and No. 25, Soil Survey of Plymouth County, Iowa, by D. S. and A. L. Gray (E. S. R., 59, p. 510).

The occurrence of podsol soils in Quebec Province, R. R. MCKIBBIN (*Science, 69 (1929), No. 1793, pp. 501, 502*).—Results of studies of certain physical and chemical characteristics of these soils are briefly reported. "The great accumulation of semidecomposed organic matter in the surface 6 to 8 in. of the podzol soils studied is especially noteworthy."

Permeability of soils (*New Mexico Sta. Rpt. 1928, pp. 14, 15*).—Continuing previous work (E. S. R., 57, p. 315), laboratory tests of a number of substances are reported as having brought about a much improved permeability and tilth. Difficulty was encountered, however, in securing sufficiently thorough mixing of the amendment with the soil in the field tests. In fact "it appears impossible to mix the amendment intimately and uniformly with the soil to any desired depth, and this must be done if the maximum of improvement is [to be] obtained." Progress of a study of the practicability of mixing the amendment with the soil by methods of cultivation normally required in the growing of the crop is noted. Analyses indicate that the soils so far tested "are in worse condition than they were 5 years ago. The lack of cultivation during the years when this land was in alfalfa undoubtedly tended to increase the hardness, the impermeability, and the alkali content. On the other hand, the cultivation given in the growing of one crop of cotton did not very appreciably improve these properties of the soil."

Conditions of the formation and constitution of the argillo-humic complex of soils [trans. title], A. DEMOLON and G. BARBIER (*Compt. Rend. Acad. Sci. [Paris], 188 (1929), No. 9, pp. 654–656*).—The authors note that the argillaceous and humus colloidal substances of the soil are generally designated collectively the absorbent complex of the soil, and name as the object of the experiments here described an investigation into the question of whether these two

groups of substances are to be regarded as coexistent in the soil or whether there exists between the two a combination such as to justify the idea of a complex properly so called. The humus preparation used in these experiments was obtained by extraction from an artificial manure made from straw. The preparation contained but very little mineral matter (about 1 per cent), that present being essentially siliceous. The clay fraction used was extracted from brick clay and was rendered base free.

The first series of experiments was designed to show the effect of the reaction upon the tendency to form a complex. It consisted essentially in placing 0.25-gm. portions of the clay, in the state of a suspension exactly neutralized with ammonia, in centrifuge tubes together with 0.025 gm. of the humic acid in neutral solution in ammonia and small quantities either of N/10 hydrochloric acid or N/10 potassium hydroxide to produce the various H-ion concentrations at which it was desired to study the behavior of the mixture, water enough to make a volume of 50 cc., and finally 1.5 cc. of saturated potassium chloride solution to flocculate the clay. The quantity of the humus substance which had been fixed by the clay was determined in each case in the unwashed precipitate by titration with alkaline permanganate. Some further experimental detail is noted. The humus substance fixed per hundred parts of the clay was found to be at pH 3.85, 9.60; at pH 5.0, 8.08; at 5.9, 7.26; at 6.95, 6.28; at 7.25, 5.37; at 7.55, 4.65; and at 8.5, 2.05. The percentage of the added humus which was fixed by the clay is also given and shows a similar, though less rapid, decline with increasing pH values.

A second series of experiments dealt with the effect of the concentration of "humate," and led to the conclusion that as in adsorption phenomena the coefficient of fixation varies, the small quantities of humic acid being found to be fixed proportionately more energetically. A third series of experiments on the formation of the complex in the presence of calcium is also noted.

As a general conclusion it is stated that colloidal clay is a factor in the fixation of humus colloids in the soil, the work presented furnishing an experimental basis for the concept of an argillo-humic complex. Cations absorbed by the clay, especially the calcium ion, condition the formation of the complex, which can be formed from its constituents and permits of equilibrium reactions.

The influence of organic matter and lime on soil moisture and on the percentage of carbon and nitrogen in field soils, J. F. Muller (*Soil Sci.*, 27 (*1929*), *No. 2, pp. 137–141*).—From a series of determinations of moisture, total carbon, and total nitrogen in 12 plats of Sassafras loam containing in certain places a considerable proportion of fine gravel, and from some other data here presented, the author of this communication from the New Jersey Experiment Stations concluded that the addition of organic matter increased the moisture content approximately twice as much as the addition of lime decreased it, the soils receiving annual applications of organic matter having in all cases but one shown a moisture content higher than that of those plats receiving minerals only or no treatment, while in all but two cases the limed soils had a moisture content lower that that of the corresponding unlimed soils. The soils receiving annual applications of such organic matter as manure or straw were found also to have a total carbon content greater than that originally present in 1909. The manured plats showed further an increase in total nitrogen. All other plats were found to show a decrease in total carbon and total nitrogen.

The pH values of the soils of the plats studied and the rainfall for approximately the period covered by the analyses are also given.

Legumes in soil improvement, A. T. Wiancko, G. P. Walker, and R. R. Mulvey (*Indiana Sta. Bul. 324* (*1928*), *pp. 24, figs. 6*).—"From 25 to 50 per cent

of the nitrogen and humus of Indiana soils has been used up or lost by the system of cropping they have undergone," according to the findings reported in this bulletin, and increasing the growth of legumes is recommended.

Experiments made in various parts of the State are described as having shown an increase of corn yields by 7.6 bu. an acre and wheat yields by 5 bu. by the inclusion of legumes in the rotation. These results are given as the averages of the yields of 100 crops grown on eight experiment fields during the past 21 years.

Among the topics discussed are how legumes increase soil fertility; the effects of legumes on Indiana soils; individual experiments on a number of farms and fields; the causes of clover failures; acid tolerant legumes; and substitutes for clover in rotations.

Effect of crop growth on the replaceable bases in some Californian soils, J. C. Martin (*Soil Sci., 27 (1929), No. 2, pp. 123–136*).—This contribution from the California Experiment Station is based upon a study of 13 soils from representative agricultural areas in the State since 1915, and includes the following conclusions:

"There are greater relative variations in the amount of replaceable bases in soils classified as of different origin than within a group of soils of uniform classification. The quantities of exchangeable bases in these clay or silty clay loam soils are generally much higher than in the sandy loam soils.

"When the soils were subjected to a prolonged period of cropping annually to barley or were cropped twice with a long fallow period intervening, there were no appreciable changes in the content of total replaceable bases. There were significant decreases of replaceable potassium in all soils cropped annually for 12 years. Nine of the 12 soils, which supported two barley crops with a 10-year fallow period intervening, show significant decreases in potassium. The content of total bases is not significantly altered by these decreases in potassium, because calcium and magnesium, which comprise 90 per cent of the total, remain constant.

"The loss of potassium from the entire group of soils supporting an annual crop of barley for 12 successive years is 32 per cent of that contained in these soils at the beginning of the experiment and is 82 per cent of the potassium removed in the crops from these soils. The losses of potassium from the same original group of soils, which have supported two crops of barley with an intervening fallow period of 10 years, are of questionable significance in several cases, but for the entire group make up 13 per cent of the original content and constitute 64 per cent of the crop withdrawal.

"The data seem to be especially significant since this experiment has been conducted under conditions which preclude the loss of any of the four bases from the soil except by crop withdrawals. These relations between losses of potassium and crop withdrawals of this constituent suggest the importance of the replaceable base complex with respect to available potassium in soils.

"The 0.05 N HCl extractable bases in these soils are compared to the ammonium acetate replaceable bases and their relations discussed briefly."

Retention of phosphate by hydrated alumina and its bearing on phosphate in the soil solution, L. B. Miller (*Soil Sci., 26 (1928), No. 6, pp. 435–439, figs. 2*).—The results of this investigation, essentially a study of titration curves of equivalent mixtures of aluminum chloride and potassium dihydrogen phosphate with sodium hydroxide as compared with the compositions of the precipitates at various pH values, indicate the specific capacity of the hydrated preciptate to retain the phosphate ion as being greatest within the pH range delimited by the beginning and the completion of precipitation, "in this case

from a pH value of about 3 [to a] pH value of about 4.5." The precipitate was found to have, through this range of pH values, the composition of normal aluminum phosphate. The addition of alkali in excess of that required for complete precipitation (to pH values above 4.5) brought about a change in the composition of the solid phase, the phosphate being "progressively replaced by hydroxyl," with a concomitant solution of the phosphate ion, this reaction having been observed to continue to the complete replacement of the phosphate content of the precipitate.

"Before the replacement of phosphate by hydroxyl in the solid phase is complete, however, a further chemical reaction begins. Above a pH of about 7.5 the precipitated alumina begins dissolving," with the formation of soluble aluminates, so that "between pH values of approximately 7.5 to 8.5 the reactions . . . proceed simultaneously. Above a pH value of 8.5 the phosphate content of the precipitate is negligible. Further addition of alkali causes the remaining precipitated alumina to form soluble aluminates."

With respect to the application of the results here discussed directly to the explanation of similar phenomena in the soil, "it must be emphasized, however, that the particular results obtained in this research apply strictly only to the particular system here described. Care and judgment must be exercised in the application of the conclusions to apparently similar systems, such as the soil solution. For example, with changed concentrations of solution, the range of H-ion concentration over which precipitation of alumina is practically complete will broaden or narrow accordingly as the concentration is increased or decreased. With the introduction of other ions, especially anions, the system changes greatly in its reactions. If these facts are borne in mind, the conclusions derived here are of general application."

Crop response to lime on acid soils, R. E. STEPHENSON (*Soil Sci., 26 (1928), No. 6, pp. 423–434*).—Based in part on some liming and fertilizer experiments at the Astoria Substation and upon rotation plats of Williamette silty clay loam and Elmira silty clay loam, and in part upon an analysis of certain theoretical considerations, this contribution from the Oregon Experiment Station presents the conclusions, among others, that apparently the supply of available essential ions is a more important factor in crop production than is the degree of acidity or even the concentration of toxic ions, this fact being recognized in the statement that fertile soils, though acid, may not be greatly in need of lime. It is recognized also in certain lime requirement methods which are graduated to a theoretical scale of fertility.

"The poorest soils are given the heaviest application of lime, whereas for the best soils is recommended a much lighter application. In Oregon it is most common to recommend not less than 1 ton of lime per acre, which is the practical minimum limit, and not more than 2 tons, which is the economic maximum limit. Rather than use heavier lime applications, it is recommended to build up and maintain general fertility. When all is stated, however, no factor or group of factors entirely control fertility. Physical soil conditions or climatic factors may at times overshadow all others. The conclusion must be, therefore, that there are several factors of fertility and great care is essential in diagnosing poor acid or infertile soils by the use of laboratory methods."

Lime penetration resulting from surface application to pasture land, P. R. NELSON (*Soil Sci., 27 (1929), No. 2, pp. 143–146*).—From a study of the calcium content with the corresponding pH values to a final depth of 12 in. in treated and untreated pasture soils, it was found that the greater part of the calcium remained where it had been applied and exerted its influence at that point. The pH values showed a tendency toward a gradual penetration by the

lime, indicating a slight, though consistent, neutralization of the soil acidity to a depth of 9 in. In addition to those of lime, the effects of potassium chloride, of superphosphate, and of gypsum were taken into consideration; but "the only fertilizer which has had the slightest neutralizing effect upon the soil is gypsum, and its effect has not influenced the change in acidity caused by the application of lime alone."

The ratio of sulfur to phosphorus in western Oregon soils and losses of sulfur through drainage and cropping, J. S. JONES (*Soil Sci., 26 (1928), No. 6, pp. 447–453, fig. 1*).—"The primary purpose of this paper is a presentation in as condensed form as possible of additional data bearing upon the actual amount of sulfur present in the soils of Oregon, together with the best local information available on losses of sulfur from soils annually by drainage water and the removal of farm crops. In mentioning the sulfur to phosphorus ratio, advantage merely is taken of an opportunity to point out wherein two generalizations somewhat current in soil literature do not hold. First, for at least two very extensive areas in western Oregon, the soils' content of sulfur never approximates their phosphorus content. Second, the commonly grown legumes, forage grasses, and grain in these areas do not draw upon the soils so heavily for sulfur as for phosphorus."

The article is a contribution from the Oregon Experiment Station.

Sewage sludge as fertilizer, W. RUDOLFS (*Soil Sci., 26 (1928), No. 6, pp. 455–458*).—Noting the Milwaukee plant as the only sewage disposal plant in the country at present marketing sludge on a large scale for use as fertilizer and presenting the results of a number of determinations of the forms of nitrogen, regarded from the fertilizer analyst's viewpoint, and of some other constituents, as determined in the Milwaukee product and in a Plainfield (N. J.) sludge, together with a tabular statement of the total nitrogen, ash content, and degree of digestion of sludges from 14 cities and towns, the author of this communication from the New Jersey Experiment Stations offers as his conclusion that the nitrogen content of sewage sludge varies with the type of treatment; that aerobically treated sludge contains about 5 per cent of nitrogen and the anaerobic product about 2.25 per cent; that there is an annual loss of from 150,000 to 200,000 tons of nitrogen; and that on the basis of the analyses of a number of sludges an estimated quantity of from 8,000 to 10,000 tons of nitrogen annually could be saved at the present time. It is noted that "at a number of places the sewage sludge is given away or sold for a small nominal sum."

Fertilizers for Indiana soils and crops, A. T. WIANCKO (*Indiana Sta. Circ. 162 (1928), pp. 8, fig. 1*).—"This circular briefly presents recommendations on the selection and use of fertilizers for different crops on different soils under different conditions in Indiana. It is intended to serve as a guide to the fertilizer manufacturers, salesmen, and local dealers, as well as farmers."

Prices of fertilizer materials and factors affecting the fertilizer tonnage, E. E. VIAL (*New York Cornell Sta. Mem. 119 (1928), pp. 159, figs. 27*).—The general nature of the information furnished, largely in tabular and statistical form, is indicated by the partial list of contents following: Phosphates—rock phosphate (production, prices of phosphate rock f. o. b. mines, seasonal variation in prices of phosphate rock, exports of phosphate rock), sulfuric acid, superphosphate, bone products, and index numbers of wholesale prices of phosphoric acid; ammoniates—mineral ammoniates, nitrate of soda, sulfate of ammonia, and index numbers of wholesale prices of mineral ammoniates; organic ammoniates—cottonseed meal, tankage, blood, fish scrap, and index numbers of prices of ammonia in organic ammoniates; potash—German pro-

duction, imports into the United States, seasonal variation in prices of potash salts, and prices of potash in the United States; index numbers of wholesale prices of 12 fertilizer materials; fertilizer manufacturing—location of plants and value of products, seasonal variation in employment in fertilizer establishments, and growth and changes in fertilizer manufacture; fertilizer consumption—regions of consumption, trends in the fertilizer tonnage, variability of the fertilizer tonnage, and factors affecting the fertilizer tonnage sold in the United States (partial and multiple correlations), seasonal variation in fertilizer sales; and a statistical appendix.

Fertilizer registrations for 1929, C. S. CATHCART (*New Jersey Stas. Bul. 482 (1929), pp. 24*).—This bulletin gives the tabulated fertilizer registrations as required by the State law, together with the guaranties as to analysis.

AGRICULTURAL BOTANY

The hydrion concentration of plant tissues, VI–IX (*Protoplasma, 2 (1927), No. 3, pp. 428–459; 3 (1928), pp. 273–301, 458–468*).—The reports previously noted (E. S. R., 59, p. 818) have given a general survey of the stem tissue reaction in several plant families and of the tissue reactions throughout the life periods of the sunflower and of the bean. These studies have given also an indication regarding the possible importance of the carbon dioxide content as a factor governing the hydrion concentration of the cell, espeially within the range of pH 6.0–4.0, which is usual in plant tissues.

VI. *Stem tissue reactions throughout the year*, M. W. Rea and J. Small (pp. 428–459).—This article summarizes the data obtained during a general survey of selected herbaceous and woody stems, examined at monthly intervals throughout the year by the method which is described in the first article above indicated. A few conclusions have been drawn from these data, but the inferences are limited to the plants and the conditions involved, though admittedly some indications may be more or less applicable to other cases.

The hydrion concentration of the inner tissues, pith and xylem, tends to remain constant throughout the year or to fluctuate only slightly without obvious correlation as regards seasonal changes. The hydrion concentration of the cortex, endodermis, and phloem tends to increase during the winter or to decrease during the summer in most species. The epidermis and subepidermis, particularly in the woody plants examined, tend toward greater acidity during some part of the winter period. The seasonal variations normally affect the outer tissues much more than the inner tissues. Each tissue and each species should be considered as an individual case in any explanation of the mechanism of these variations. Apart from seasonal changes, a general increase in acidity is found to attend lignification and similar processes occurring in the lower stems, especially in the shrubbery plants. These conclusions are discussed.

VII. *The buffers of sunflower stem and root*, S. H. Martin (pp. 273–281).—The normal reactions of the sap of roots and stems (exclusive of crowns or stem tips) of mature *Helianthus annuus* are buffered as in the hypocotyl of the seedling by a dilute concentration of inorganic phosphates present in solution in the cell sap.

VIII. *The buffers of bean stem and root*, S. H. Martin (pp. 282–301).—In an experimental study of buffer conditions in expressed sap of broadbean stem and root, the inorganic phosphate content was determined. The buffer value of the expressed sap was determined by titration with standard alkali, and the results so obtained were calculated in terms of molar phosphoric acid. Stem and root sap exhibited in general, similar phenomena. Variability was noted

in the amounts of inorganic phosphates present, as was also variation in amount of buffer action. At all reaction points determined the sap of stem or root showed a buffer capacity higher than that due to the contained inorganic phosphate, and in all cases the buffer value of the sap increased as titration proceeded toward an arbitrary end point, which was pH 6.8 in most cases. The differences between H_3PO_4 content and buffer values, at the various reaction points determined, apparently bore no definite relation to the actual amounts of inorganic phosphates in solution in the cell sap. Preliminary qualitative tests indicated the presence of oxalates and malates. In connection with determinations which are particularized, it appeared necessary to remember that the situation, including buffer conditions and such matters as the physical and chemical states of numerous substances may be even more complex within the living cell than in the expressed sap.

IX. *Improved technique for the R. I. M.*, C. T. Ingold and J. Small (pp. 458–468).—As a result of the investigations showing that the juices of plants may be only slightly buffered, it is concluded that the range indicator method noted in the first article of this series (E. S. R., 59, p. 818) should be improved by the use of standard alcoholic indicators only after dilution with distilled water to 10 per cent or below, by the use of specially prepared indicators containing 10 per cent or less of alcohol, by the use (where this is possible) of aqueous indicators, by the reduction of the period of immersion to a minimum period (1 minute to 12 hours) consistent with the obtaining of unequivocal color indications, and by the use of all indicators with the indicator brought as near as practicable to its neutral point so that even a slightly buffered plant fluid may be able to throw the indicator to one side or the other of the neutral point. A further improvement consists in the use of fresh conductivity water (not over 2 days old) instead of the neutral water described in the original technic.

The regulation of hydrogen-ion concentration in succulent tissue [trans. title], V. Úlehla (*Protoplasma, 3 (1928), pp. 469–506, figs. 8*).—During study of stem sections of *Opuntia phaeacantha* in contact with dilute aqueous solutions of hydrochloric acid and of potassium hydrate, it was found that the pH of the solution was regulated to equilibrium in the neighborhood of the value 5.6. It appears that the cell surfaces condition the external regulation, and that these parts contain the regulatory mechanism. The contrasting behavior of dead tissue is discussed, as are other data which are detailed.

Permeability of protoplasm [trans. title], W. S. Iljin (*Protoplasma, 3 (1928), pp. 558–602, figs. 23*).—Plant cells in water or in salt solutions show a loss in carbohydrate content due to exosmosis. This loss may range from 1 to 2 per cent of the green weight, or even higher. Plant cell protoplasm is readily permeable to fructose, glucose, saccharose, and inulin. The presence of certain salts named influences greatly the permeability of protoplasm. This property can be varied considerably by making changes in the pH of the medium. In water or in salt solution permeability lessens continuously.

Studies on the permeability of an isolated living membrane [trans. title], E. Wertheimer (*Protoplasma, 2 (1927), No. 4, pp. 602–629, figs. 7*).—A synthetic review of contributions is presented, with an account of studies dealing with physiologically important influences bearing upon permeability, water movement through living membrane, and relations between permeability and the effects of materials.

The exosmosis of dissolved substance from storage tissue into water, W. Stiles (*Protoplasma, 2 (1927), No. 4, pp. 577–601, figs. 2*).—An experimental study is outlined of the course of osmosis into distilled water from storage tissue, chiefly of the beet root but also of that of the carrot, turnip, and parsnip, and the tuber of Jerusalem-artichoke and several varieties of potato.

Tissue simply kept immersed in water at 20° C. soon loses its vitality. Exosmosis of electrolytes and other substances continues until it is dead, which change requires only two or three days. Under continuous movement with removal of the container stoppers once a day, the tissue will retain its vitality for three or four weeks. This difference is attributable to the removal, in case of the shaken tissue, of the oxygen and carbon dioxide diffusion shells over the tissue.

When storage tissue is immersed in distilled water exosmosis increases electrical conductivity and total solutes for one or more days, then giving place to a decrease, indicating reabsorption by the tissue of the solutes which have come out from it. Reasons are given for supposing that the solutes which diffuse into the water from the tissues are from the cut shells or cells bordering these, and that the living cells within the disks of tissue then absorb them. Absorption of solutes by these living cells probably proceeds so long as the cells retain their vitality, but diffusion from dead and dying cells proceeds from the latter in all directions so that much of the solute passes into the external solution. The amount of electrolyte and total solute present in the external liquid results from two processes, exosmosis from surface and subsuperficial cells and absorption by inner living cells. In considering the results of this investigation, it is held that no plasmatic membrane, as distinct from the whole protoplasmic layer, is required to explain them. The theory is put forward in tentative outline that solute absorption by plant cells consists in two processes, adsorption by, or chemical combination with the protoplasm, and diffusion through the protoplasm into the vacuole.

Salt concentration and growth [trans. title], W. ESTOR (*Centbl. Bakt.* [*etc.*], *2, Abt., 72 (1927), No. 15–24, pp. 411–443, figs. 27*).—This report is intended to convey preliminary quantitative (tabular and graphical) information regarding the relations between bacterial and fungus growth and the concentration of some neutral salts.

The effect of boron deficiency on the growth of tobacco plants in aerated and unaerated solutions, J. E. MCMURTREY, JR. (*Jour. Agr. Research* [*U. S.*], *38 (1929), No. 7, pp. 371–380, figs. 5*).—The results are given of water-culture studies of the tobacco plant. It was found to be impossible to grow the plants in nutrient solutions dissolved in distilled water, but when boron was added at the rate of 0.5 part per million normal plants were produced. Boron deficiency was said to have been characterized by injury of the terminal buds, and it differed from that caused by calcium deficiency in that in a lack of boron the bases of the young leaves were injured, while the tips and margins were affected where there was a lack of calcium.

In connection with these experiments it was found that tobacco plants grow much better in aerated than in unaerated solutions. The most marked effect of aeration was shown in superior root development during the early growth of the plant, followed later by a decided increase in top growth. In preliminary trials no increase in growth was obtained with cultures through which nitrogen gas was bubbled, and this was held to indicate that the action of aeration was not due to simple stirring or agitation of the culture media.

The action of carbon disulfide on plants [trans. title], F. MUTH (*Zellstimulationsforsch., 3 (1927), No. 1, pp. 15–62, figs. 18*).—The author details work undertaken and results obtained with stimulants applied to *Lepidium sativum*, *Sinapis alba*, *Fagopyrum esculentum*, and *Pisum sativum*, listing 162 titles of related literature.

The question of X-ray stimulation in plants [trans. title], K. LINSBAUER (*Zellstimulationsforsch., 3 (1927), No. 1, pp. 97–101*).—A discussion, citing views and relevant contributions.

Pollen-tube growth at various temperatures, J. T. Buchholz and A. F. Blakeslee (*Amer. Jour. Bot., 14 (1927), No. 7, pp. 358–369, figs. 3*).—The authors call attention to the critical review of the literature on the physiology of pollen-tube growth given by Brink (E. S. R., 55, p. 521), also to the lack of literature on the influence of temperature in this connection.

During the previous five years, the authors were engaged in a cooperative study on pollen tubes of *Datura stramonium* and some of its mutants (E. S. R., 47, p. 221) with the object of discovering any significant peculiarities in pollen-tube growth bearing upon the causes of the general nontransmissibility through the pollen of certain chromosomal mutant types (E. S. R., 61, p. 24). The technic, now so far developed as to be useful though not yet perfected, is essentially a method of dissection. The data obtained are presented chiefly in tabular form. Sources of error are pointed out. When the average growth rates were plotted against temperatures it was seen that the effect of temperature on pollen-tube growth was very great. The optimum temperature for pollen-tube growth rate was near 33.3° C., with a slight falling off in the rate at 37°. At 33.3° the growth rate was 4.5 times the rate found at 11.1°. Rigid temperature control appears to be an absolutely necessary condition of reliability in quantitatively comparative studies on pollen-tube growth.

Distribution of chlorophyll and of peroxidase content of the epidermis in variegated plants [trans. title], V. Rischkow (*Biol. Zentbl., 47 (1927), No. 8, pp. 501–512, figs. 2*).—Results of the examination of a number of plants named show that chlorophyll is oftener present in the epidermis of variegated and normally green plants than is usually supposed.

Variegated plants belong in two groups. In one the variegation bears no relation to the chlorophyll content of the epidermis. In the other the epidermis overlying colorless parenchyma has less chlorophyll than that over green mesophyll, or else none at all. Plants of different species under similar light conditions may show differences as regards epidermal chlorophyll content. Chlorophyll-bearing epidermis may be found in different ecological plant groups. One case is known of its occurrence in the succulents (*Mesembryanthemum cordifolium*).

New native species of Rhizopus as starch transformers [trans. title], W. Nill (*Centbl. Bakt.* [etc.], *2. Abt., 72 (1927), No. 1–7, pp. 21–38, pls. 2, fig. 1*).—From native wheat and meal three species of Rhizopus were isolated and numbered as morophologically and physiologically separable from the forms hitherto known, and therefore regarded as new species. The growth optimum temperature for each is high (±38° C.), as is also the capability to transform starch into sugar, which is said to range as high as in the cases of the technically useful forms *R. delemar*, *R. tonkinensis*, and *Aspergillus oryzae*, and three or four times as high as in *A. flavus*. Other characters are detailed.

Nitrogen fixation by bacteria on artificial media [trans. title], G. Stiehr (*Centbl. Bakt.* [etc.], *2. Abt., 71 (1927), No. 8–14, pp. 265–267*).—It is claimed that legume nodule bacteria developing in agar increased decidedly the total nitrogen content of the bacterial slime.

Studies upon bacterial spores.—I, Thermal resistance as affected by age and environment, C. A. Magoon (*Jour. Bact., 11 (1926), No. 4, pp. 253–283*).—As a result of study, the practical bearings of which are somewhat particularly significant in connection with the prevention of spoilage in foods, it is concluded that the bacterial spore, commonly supposed to be dormant under ordinary conditions, is sluggishly active.

The degree of resistance of bacterial spores to heat is variable, being influenced at least by the factors age, temperature, and humidity. The highest

degree of resistance to heat develops under conditions of moderate temperature and humidity, probably by the time when the spores are 60 days old, though differences are to be expected. Resistance change is slowest when the spores are dry and cold, but the condition of low temperature combined with high humidity develops high resistance.

In estimating, for the purpose of practical sterilization, the death points of spores, account should be taken of the alterations of resistance which correspond to changes produced as above indicated, in order to be as certain as possible that the resistance shown by the test spores represents the highest degree attainable.

Biology and classification of Podosphaeras in Pomaceae [trans. title], A. M. MAURIZIO (*Centbl. Bakt.* [*etc.*], *2. Abt., 72* (*1927*), *No. 1–7, pp. 129–148, figs. 6*).—*Podosphaera oxyacanthae* and *P. leucotricha* are dealt with in detail.

GENETICS

[Contributions to plant genetics] (*Internatl. Cong. Plant Sci.* [*Ithaca, N. Y.*], *Proc., 1926, vol. 1, pp. 787–946, figs. 43*).—Papers presented in the genetics section of the International Congress of Plant Sciences in Ithaca, N. Y., in August, 1926, and detailed in these pages embraced Reciprocal Hybrids [trans. title], by E. Lehmann (pp. 787–801); Multiple Allelomorphs Versus Multiple Factors, by M. J. Sirks (pp. 803–814); Preliminary Experiments in Self- and Interfertility of Pistacia, by G. Savastano (pp. 815–820); The Cytology of Plant Species Hybrids with the Same Chromosome Numbers as the Parents [trans. title], by G. Tischler (pp. 821–830); An Attempt to Analyze the Composition of Nubbin, a Compound (2n+1) Chromosomal Type in Datura (Abstract), by A. F. Blakeslee (pp. 831, 832); A Case of Linkage of a Higher Order, by E. Malinowski (pp. 833–836); Species Hybridizations Among Old and New Species of Shepherd's Purse, by G. H. Shull (pp. 837–888); The Concept of the Gene, by E. M. East (pp. 889–895); The Gene as the Basis of Life, by H. J. Muller (pp. 897–921); The Bearing of Variegations on the Nature of the Gene, by W. H. Eyster (pp. 923–941); and Mutable Genes in Drosophila Virilis, by M. Demerec (pp. 943–946).

Cytological studies in the Betulaceae.—I, Betula, R. H. WOODWORTH (*Bot. Gaz., 87* (*1929*), *No. 3, pp. 331–363, pls. 2*).—Studies at Harvard University upon a number of species and forms of birch showed this genus to be characteristically polyploid, containing diploid, triploid, tetraploid, pentaploid, hexaploid, and dysploid forms. Species of birch were found to hybridize freely, a condition which has given rise to many different forms within the genus. The author believes that hybridism is the cause and polymorphism the effect. Hybridization leads to the production of polyploid gametes by semiheterotypic division and by nonreduction; consequently, heterozygosis is to be considered one of the methods of the origin of polyploidy.

Cryptic types in Datura due to chromosomal interchange and their geographical distribution, A. F. BLAKESLEE (*Jour. Heredity, 20* (*1929*), *No. 4, pp. 177–190, figs. 19*).—This account of the behavior of chromosomes in Datura, illustrated by diagrams and models, touches upon the effects of extra parts of chromosomes, formation of chromosome rings, chromosomal repulsion, distribution of types, and pollen abortion in hybrids.

A 2n–1 chromosomal chimera in maize, B. MCCLINTOCK (*Jour. Heredity, 20* (*1929*), *No. 5, p. 218, fig. 1*).—In the F_1 of a cross between triploid and diploid corn at Cornell University an individual appeared whose microsporocytes showed a 2n–1 chromosome complement. Several root tips were examined, and all clear figures showed 20 chromosomes. "*Such evidence points to the fact*

that early in the ontogeny of the upper part of this plant a chromosome must have been lost."

Yellow stripe—a factor for chlorophyll deficiency in maize located in the Pr pr chromosome, G. W. BEADLE (*Amer. Nat., 63 (1929), No. 685, pp. 189–192*).—The chlorophyll defect in corn studied at Cornell University and termed "yellow stripe" behaved as a simple Mendelian recessive. Linkage tests indicated that the factor pair differentiating normal and yellow stripe plants, *Ys ys*, lies in the *Pr pr* chromosome relatively close to the *Pr pr* locus.

A note on yellow fatuoids, H. H. LOVE and W. T. CRAIG (*Jour. Heredity, 20 (1929), No. 4, p. 172*).—Their observation of yellow fatuoids in cultures at the New York Cornell Experiment Station and yellow wild oats in fields in California, together with the findings by Stanton and Coffman (E. S. R., 61, p. 25) of yellow-kerneled fatuoid oats, led the authors to suggest that the opinion of Jones (E. S. R., 57, p. 123) must be modified when all varieties or strains of yellow oats are considered. Since certain, but not all, yellows inhibit awns, yellow fatuoids should occur in some varieties and not in others, and it may be that the inhibition is limited to strains.

Hetero-fertilization in maize, G. F. SPRAGUE (*Science, 69 (1929), No. 1794, pp. 526, 527*).—Hetero-fertilization is applied by the author to the process resulting in those exceptional cases in which the endosperm and embryo differ genetically. Such cases appeared in studies on the inheritance of scutellum color in corn. There was some evidence that hetero-fertilization may occur only in the presence of a certain gene or complex of genes. Possible causes of the phenomena are discussed.

The relation between length of styles and Mendelian segregation in a maize cross, P. C. MANGELSDORF (*Amer. Nat., 63 (1929), No. 685, pp. 139–150*).—In a study of the deficiency of sugary seeds in the F_2 endosperm generation noted in crosses between Rice pop corn and sugary corn, reported from the Texas Experiment Station, the results suggested that there may be differences between the *Su* and *su* pollen grains in rapidity of germination as well as in rate of growth.

A comparison between normal and short styled ears showed that in the initial stages of growth an increase in stylar distance is accompanied by a decrease in percentage of sugary seeds. Data from four ears indicated rather convincingly that there also may be regions where the percentage of recessives increases with the stylar distance. "The natural conclusion is that the difference in rate of growth of the *Su* and *su* tubes is not a constant one. Though the total growth of the *Su* tubes is greater at practically all points, the rate of growth is first higher for the *Su* tubes, later for the *su* tubes. There is also the possibility that the maximum growth of which the pollen tubes are capable is greater for the *su* than the *Su* tubes. In other words, if the stylar distance is sufficiently long the percentage of sugary seeds will approach 25 per cent and may actually exceed it."

Linkage studies of factor pairs for normal vs. glossy seedlings and flinty vs. floury endosperm in maize, H. K. HAYES and H. E. BREWBAKER (*Amer. Nat., 63 (1929), No. 686, pp. 229–238*).—Further data (E. S. R., 59, p. 126) are given in regard to the linkage relations of flinty v. floury (*Fl fl*) and of normal v. glossy seedlings in corn.

Inheritance in Nodak and Kahla durum wheat crosses for rust resistance, yield, and quality at Dickinson, North Dakota, J. A. CLARK and R. W. SMITH (*Jour. Amer. Soc. Agron., 20 (1928), No. 12, pp. 1297–1304*).—In a cross between Nodak, a yellowish glumed, rust resistant, high yielding wheat variety of only fair quality, and Kahla, a black glumed, rust susceptible, low yielding,

high quality variety, studied at the Dickinson, N. Dak., Substation, glume color was found to be controlled by a single genetic factor, black being dominant to yellowish. Susceptibility to stem rust was dominant to resistance, with indication of at least two genetic factors involved. In yield, F_1 plants were intermediate between the parents, and certain F_3 strains outyielded the best parent checks.

The crude protein content and the gasoline color value of the F_3 strains were intermediate as to those of the parents, with an indication of transgressive inheritance beyond the parents for both high and low protein content and for both high and low color. It seemed that the tests of crude protein content and gasoline color value furnished a basis for selecting hybrid strains for high quality. A significant and important negative correlation found between crude protein content and gasoline color value appeared to indicate the necessity for considering both these quality factors as well as rust resistance and high yield in breeding durum wheats.

Multiple kernels in wheat-rye hybrids, R. P. Bledsoe (*Jour. Heredity, 20 (1929), No. 3, pp. 137–142, figs. 4*).—Double and triple kernels were found in florets of Georgia rye at the Georgia Experiment Station. Examination of flowers of plants with double and triple kernels showed a condition resembling that described by Leighty and Sando (E. S. R., 51, p. 825) in wheat from Argentina; i. e., the stamens in a number of the flowers were transformed into carpels or into structures which were partly stamens and partly carpels. In addition, in some of the flowers the three stamens were either normal, partly modified, or entirely transformed into carpels; and, furthermore, there were two, three, four, and occasionally five carpels. In some of the flowers the pistil had three stigmas. A double kernel was also found in a wheat × rye hybrid. The variations described evidently were inherited and not caused by abnormal growing conditions. Mutation and hybridization are discussed as possible causes.

Wheat-rye hybrids, M. M. Hoover (*Jour. Heredity, 20 (1929), No. 4, pp. 170, 171, fig. 1*).—Wheat-rye hybrids found in Fultz 7 wheat at the West Virginia Experiment Station resembled wheat rather closely, although intermediate in most plant characters.

Matrocliny in flower size in reciprocal F_1 hybrids between Digitalis lutea and Digitalis purpurea, J. B. Hill (*Bot. Gaz., 87 (1929), No. 4, pp. 548–555 figs. 3*).—Genetical studies at the Pennsylvania Experiment Station showed that the reciprocal F_1 hybrids in the above-cited cross are unlike and matroclinous in respect to flower size, the differences appearing in both the corolla and the calyx.

Cytological conditions and evidences for hybridity in North American wild roses, E. W. Erlanson (*Bot. Gaz., 87 (1929), No. 4, pp. 443–506, pls. 4, figs. 4*).—A total of 107 wild roses from known stations in North America were examined at the University of Michigan and found to fall for the most part into the diploid, tetraploid, and hexaploid classes, with seven as the basic chromosome number. One specimen was octoploid, two were triploid, and three aneuploid, with the somatic number not a multiple of seven. The diploid species were characteristically vigorous and larger as a rule than the related polyploid forms. Crossing evidently occurred in the field between different diploid species, giving rise to at least partially fertile diploid progeny. Some diploids were found with almost entirely good pollen, while others possessed from 10 to 15 per cent of sterile grains. Most tetraploid forms showed from 15 to 30 per cent of sterile pollen, but one had from 56 to 77 per cent of poor pollen.

It is emphasized that the study does not support the Hurst theory of differential septets in Rosa (E. S. R., 60, p. 529), which suggested that sets of seven chromosomes separate together during meiosis.

The measurement of gene mutation rate in Drosophila, its high variability, and its dependence upon temperature, H. J. Muller (*Genetics, 13 (1928), No. 4, pp. 279–357, figs. 2*).—The author summarizes a number of the experiments conducted at the University of Texas dealing with the variation in mutation rate in Drosophila and the effect of temperature on the variation in rate of mutation. He further outlines the methods of identifying mutant genes by the aid by balanced lethals, and gives suggestions for simplifying the methods for testing and identifying new mutations by the aid of balanced lethals.

The persistence of differentiation among inbred families of guinea pigs, S. Wright and O. N. Eaton (*U. S. Dept. Agr., Tech. Bul. 103 (1929), pp. 46, figs. 25*).—As was noted in a previous publication (E. S. R., 48, p. 469), five strains of guinea pigs which were continued by brother and sister mating showed a loss in vigor as judged by weight, fecundity, and vitality of the young in comparison with control stock. The individual families also showed marked differentiation from each other in these respects as well as in other characteristics. During the nine years 1916–1924, the five inbred strains showed no further decline as a group in comparison with the control stock than was observed during approximately the first 12 generations of inbreeding. Each strain differed significantly from each other in average weight, but there was no significant difference in the trend as determined by a study of the regression of the differences from year to year between families. Other characteristics showed some difference in trend. Two families showed a rise in every respect, while one family showed a falling trend in every respect except weight. These differences are explained as the result of differential response to changing conditions and not because of a variation in genetic factors. Nevertheless particular lines within each strain indicated genetic changes due to segregation or mutation in some cases during the second 9-year period.

The results are explained in accordance with the Mendelian theory of inbreeding by assuming that homozygosis fixes the ranking of inbred strains with respect to weight, but merely their average reaction to particular conditions with respect to fecundity and mortality characters.

The effects in combination of the major color-factors of the guinea pig, S. Wright (*Genetics, 12 (1927), No. 6, pp. 530–569, figs. 10*).—The results of a critical study of the part played by the different genes in the production and modification of intensity and degree of color, based on the grades of a large number of guinea pigs and comparing the grades with the amount of white, black, yellow, and orange as determined in the fur by color disks, are reported. In the guinea pig the quality and intensity of the yellow and sepia pigments are largely determined by the genes of the series *C*, *F*, *P*, and *B* and their distribution by the series *S*, *E*, and *A*.

The behavior of the albino series in different combinations is of interest. In the combination *FPB* and *FPb*, the intensity of the fur is increased by the genes of this series in the order c^a, c^d, c^r, c^k, and *C*, but in the eyes the order is c^a, c^r, with c^d, c^k, and *C* indistinguishable. In the yellow parts of the fur c^a and c^r causes white, c^d and c^k cream, and *C* red. The order of the intensity of sepia produced in the albino series is changed in the presence of *p* to c^a, c^r, c^d, c^k, and *C*. Factor *b* replaces black by brown, but has no effect on yellow and does not change the albino series order. Factor *f* reduces the level of yellows in all combinations not already white and makes c^{kd} c^{ra} combinations

white. *Factor f has no effect on sepia in P combinations, but eliminates sepia in the presence of p, leaving a pale cream or white.*

Changes in intensity of color were noted to occur with age, sepia becoming darker and yellow lighter. Plucking the hair had a similar but more pronounced effect. The author suggests an explanation for pigmentation based on the presence of a product designated as I, which is assumed to be a precursor of yellow and which in competition with a second product designated as II may produce the grades of sepia. The genes of the albino series (*C*) have different thresholds of effectiveness on I, while II is modified by *P*, *A*, and *E*. The competition between I and II after being effected by the above factors may be further modified by the factors *B* and *F*.

FIELD CROPS

[Agronomic experiments in New Mexico] (*New Mexico Sta. Rpt. 1928, pp. 15, 16, 43–49, 59, 60, figs. 2*).—Varietal leaders in continued experiments (E. S. R., 59, p. 222) included Burbank and Turkey wheat, Oklahoma Red and Texas Red oats, and G2.518 barley of the fall-sown cereals, and Sonora and Dicklow wheat, Kanota and Ferguson 71 oats, and Hanna and Colsess barley of spring-sown grain, Acala cotton, Peruvian alfalfa, and Pennsylvania Broad Leaf tobacco. Variety tests of corn, grain sorghum, sorgo, broomcorn, oats, barley, beans, millet, and forage mixtures, and seeding tests with wheat are also reported on from experimental fields in northeastern New Mexico.

In the annual production of sugar beet seed, the highest seed yields came from the September 15 planting and also when planted at the rate of 18 lbs. per acre and left unthinned. The low viability of the 1927 seed was believed to be due to climatic conditions at the time the seed was set or the failure to irrigate properly during the pollination period. It was demonstrated rather conclusively that rows of the width ordinarily used for corn or cotton were not suitable for the production of sugar beet seed, and all indications seemed to favor thick plantings.

While single cotton plants 12 in. apart yielded 16 per cent more than unthinned cotton, yields from 12-in. or wider spacing did not differ much. Cotton topped at three different dates did not yield very differently from untopped cotton. Cottonseed from composited weekly ginnings (between October 8 and December 3) from different gins in the Rio Grande Valley had a rather uniform oil content over the period, averaging 24.1 per cent, while the protein content, averaging 23 per cent, tended to increase in the later weeks. The cottonseed thus contained as much of the commercially valuable constituents at the end of nine weeks as at the beginning of the season. Storage of bales of cotton under various conditions in cooperation with the U. S. Department of Agriculture gave indications that cotton bagging was just as good as, if not superior, in every way to the ordinary jute bagging.

Test results suggested that the germinating qualities of seed of winter fat (*Eurotia lanata*) deteriorate rather rapidly with age, that the seed germinates best in cool or cold weather, and that the planting should be quite shallow. Winter fat planted February 24, 1928, and irrigated several times early in the growing season, by the end of the season had averaged about 18 in. in height, and some of the larger bushes had matured a good seed crop. Seed of *Valota saccharata*, a native grass, failed to germinate in test plats irrigated lightly, whereas comparatively good germination was had with heavier irrigation. Planted July 3 and 6, 1928, and irrigated every few weeks, the grass yielded a good seed crop.

Plants appearing to be drought enduring in range studies (unirrigated) included Tobosa grass (*Hilaria mutica*), *V. saccharata*, a dropseed grass (*Sporobolus strictus*) and winter fat.

[Tillering below the crown at the seed in cereals], M. F. Gladkiĭ and D. F. Lykhvar (*Nauch. Agron. Zhur.* (*Jour. Landw. Wiss.*), *4* (*1927*), *No. 5–6, pp. 355–369, figs. 4; Eng. abs., pp. 368, 369*).—Winter wheat under favorable conditions, e. g., with adequate soil moisture (about 18 per cent), grown under cultural practices tending to increase soil moisture or when free from Hessian fly and other pests, may develop tillers at the seed, whereas such tillers occur only to a limited extent in winter rye and seldom in spring wheat and barley. Varietal differences were noted in the ability to produce these tillers, and the tillering from the lower node increased with the extent of injury to the crown tillers. Spikes were borne by a varying proportion of the tillers at the seed.

Notes on trials of leguminous plants at the Scott Agricultural Laboratories, W. L. Watt (*Kenya Colony Dept. Agr. Bul. 1* (*1929*), *pp.* [*1*]+*9*).—Significant characteristics are tabulated from the results of tests for 104 sorts of legumes.

Penalties of low food reserves in pasture grasses, L. F. Graber (*Jour. Amer. Soc. Agron., 21* (*1929*), *No. 1, pp. 29–34, figs. 3*).—This is a more detailed account of the detrimental effects of overgrazing permanent pastures observed at the Wisconsin Experiment Station (E. S. R., 61, p. 128).

Barley varieties registered, II, H. V. Harlan, R. G. Wiggans, and L. H. Newman (*Jour. Amer. Soc. Agron., 20* (*1928*), *No. 12, pp. 1326–1328*).—Varieties of barley approved for registration since the previous report (E. S. R., 56, p. 433) include Velvet and Glabron.

A basis for the valuation of malting barley, T. J. Harrison (*Sci. Agr., 9* (*1929*), *No. 9, pp. 599–610, figs. 4*).—The method outlined in this contribution from the Manitoba Agricultural College is suggested for obtaining a single figure value for Canadian malting barley.

Red clover seed for Indiana, A. T. Wiancko and R. R. Mulvey (*Indiana Sta. Circ. 160* (*1928*), *pp. 4, fig. 1*).—Further tests (E. S. R., 54, p. 830) in 1926, 1927, and 1928 showed that native strains of red clover excelled all others in winter hardiness and hay production. Oregon seed, which comes largely from the Willamette Valley, was least desirable among American clovers. European clovers did not differ markedly among themselves, except that Italian seed was wholly unadapted due to severe winterkilling. The locally adapted seed, including that from Ohio, produced half again as much second growth as other North American strains, while foreign clovers were particularly lacking in this respect. Native red clover was able to withstand ravages of leafhoppers much better than red clover from Europe or Chile. Single-cut clovers from northern Europe were as winter hardy and produced a first growth equal to the average of native common red clover but killed entirely after cut for hay.

Relation of certain ear and kernel characters of Reid Yellow Dent corn to yield, H. D. Hughes and J. L. Robinson (*Iowa Sta. Bul. 257* (*1929*), *pp. 169–208, figs. 13*).—Ear and kernel characters in their relation to yield were studied in 1916, 1917, and 1918 on individual ears of Reid Yellow Dent corn. All ears produced on a given area in 3-stalk hills and surrounded by 3-stalk hills were included regardless of size, shape, or weight. Each ear was planted in duplicate 25-hill rows and the yields (air-dry corn) corrected to soil and to uniform number of plants.

Yield was found to be related definitely to length of ear, weight of ear, number of rows, and space between rows on the ear and the kernel characters starchiness, density, blistering, kernel tip development, volume, weight, depth, and thickness.

The larger yields were obtained from the longer and heavier ears, ears with 16 rows of kernels, ears with medium to wide space between rows than from ears with close spacing, ears with medium to smooth indentation than from rougher ears, ears with dense, horny kernels than from ears with light, starchy kernels, ears with relatively large kernels than from those with shallow, smaller, thinner kernels, and ears fully mature and cured normally than from ears from blistered kernels and poorly filled kernel tips.

Ear circumference, the filling of the ear tip, the filling of the butt, and the size of germ were only slightly related to yield, although the lowest yields came from the planting of ears with the smallest circumference, the poorest filled ear tips, the poorest filled butts, and with the smallest germs. However, the differences were insignificant in most cases. The shape of the ear evidently was not related to yield.

When the same groups of seed ears used in ear and kernel studies were scored for yield by different persons not so great a difference in yield resulted in ears selected as best and as poorest as would be expected. However, the groups of ears scored lowest rather consistently produced the poorer yields and those with the higher scores the better yields.

The relation of seminal roots in corn to yield and various seed, ear, and plant characters, P. C. MANGELSDORF and S. F. GOODSELL (*Jour. Amer. Soc. Agron., 21 (1929), No. 1, pp. 52–68*).—Seminal roots (temporary roots exclusive of the radical) were studied as to their relation to other characters in corn on 100 ears of Surcropper, a white dent, planted at the Texas Experiment Station and four substations and on the remnants of these ears.

The number of seminal roots appeared to vary significantly with position of the seed on the ear, decreasing from butt to tip, and with differences in temperature and moisture during germination. The number of seminal roots increased with temperature to about 33 to 34° C., after which a further rise in temperature was accompanied by a decrease in the number of roots. Each ear seemed to have relatively the same average number of seminal roots under different conditions. Samples of 20 kernels each were found enough for the determination of the number of seminal roots under uniform conditions.

The number of seminal roots proved to be independent of length, diameter, or shape of ear, and of number of rows of kernels, length, width, degree of denting, appearance, or specific gravity of kernels. Ears without discoloration of the shank had a slightly higher number of seminal roots than ears with discolored shanks. Number of seminal roots was positively and significantly correlated with vigor of seedlings when the seeds were germinated between blotters and transplanted to soil, but negatively and significantly correlated with kernels planted directly in soil. Number of seminal roots was found to be independent of date of silking, plant height, ear height, number of tillers, percentage of fallen plants, and percentage of smut infected plants, although a slight association with number of nodes of the progeny plants was indicated. Five generations of self-pollination in four strains resulted in a marked and progressive reduction in the number of seminal roots.

Correlation was not found between seminal roots and yield in four tests, and only a barely significant correlation of 0.21 occurred in the fifth test. Number of seminal roots was held of no value as a criterion for selection of productive seed ears under the experimental conditions.

Development of the cotton boll as affected by removal of the involucre, T. H. KEARNEY (*Jour. Agr. Research [U. S.], 38 (1929), No. 7, pp. 381–393, figs. 4*).—Complete removal of the involucres of Pima (American Egyptian) cotton flowers on the day of anthesis at Sacaton, Ariz., caused significant reduction in the external dimensions of the boll and in the weight of its dry

contents, in the weight of individual seeds, and in the abundance of lint (lint index).

The period from anthesis to the opening of bolls was curtailed by from 3 to 4.5 days. Reduction in weight of individual seeds was about the same whether the involucres were removed from only four flowers on each plant or from all flowers produced during 6 weeks, an average of 48 flowers per plant, suggesting that the involucre contributes materially to the nutrition of the boll it subtends but only slightly to the plant in general. The reduction relative to the unmutilated control flowers in weight of seed cotton per boll, in weight of individual seeds, and in lint index was about the same whether the involucres were removed on the day of anthesis or from 10 to 14 days before. The mean number of seeds per boll was little if at all reduced by removal of the involucre on the day of anthesis, but it dropped significantly when removal was from 10 to 14 days before anthesis. The earlier removal also resulted in reducing the mean lint length by nearly 3 mm. The significance of these phenomena are discussed briefly.

Nondehiscence of anthers in Punjab-American cottons, T. TROUGHT (*India Dept. Agr. Mem., Bot. Ser., 17 (1928), No. 1, pp. 5, pls. 2*).—Nondehiscence of anthers in cotton flowers was observed in 1926 at Lyallpur in the Punjab-American types 4F, 285F, and 289F and also in an Egyptian variety. The 285F seemed more susceptible than 4F. The fact that nondehisced anthers contained pollen which was shriveled and had apparently received a check in growth suggested that the first cause of dehiscence might be connected with growth of the pollen grain. Observations in 1927 indicated that conditions favorable to plant growth appear to favor dehiscence and conditions adverse to growth increase the amount of nondehiscence. Neither fertilizer treatment nor cultural conditions were responsible for much variation in percentage of nondehiscence.

Studies in Indian pulses.—I, Lentil (Ervum lens, Linn.), F. J. F. SHAW and R. D. BOSE (*India Dept. Agr. Mem., Bot. Ser., 16 (1928), No. 6, pp. 155–189, pls. 6*).—Characteristics of the lentil discussed briefly include cultural requirements, root system, flowering, pollination, cross-fertilization, and hybridization. Sixty-six unit species isolated from bazaar samples are described and grouped into a determinative key.

A biometrical analysis of the effect of environment on a pure line of oats, A. ATKINSON and H. H. LOVE (*Jour. Amer. Soc. Agron., 20 (1928), No. 12, pp. 1251–1291, figs. 7*).—A pure line of Sixty-Day oats was grown cooperatively at the Montana Experiment Station and the New York Cornell Experiment Station from 1912 to 1919, inclusive. From 1915 on, seed was exchanged by each station for comparison with locally produced seed. The data on a number of characters were analyzed biometrically to determine the changes, if any, effected by growing the oats under widely different environments.

The New York soil contains 50 per cent more organic matter and slightly more phosphorus than the Montana soil, while the latter, more favorable for cereals, contains over four times as much calcium and about twice as much potassium as the New York soil. As represented by the stations, New York has more degrees of growing temperature during the growing season, while Montana has more daylight hours, a higher percentage of daylight hours with sunshine, and the higher daylight-sunshine-growing-temperature factor. The climatic conditions favor heavier growth in Montana than in New York.

The oats plants grown in Montana were generally larger and produced more culms and more grain. However, this increase was not permanent. The nature of the variability of plants produced under the different environments was

practically the same. In some instances the variability was greater in New York than in Montana, e. g., in the average number of kernels per culm and the average weight of kernels per culm, whereas higher variability for the average weight of kernel was obtained with the Montana grown plants. These changes in variability were caused by such factors as the different environmental conditions, which affected the means or standard deviations, causing higher or lower coefficients of variability.

The correlation of characters was affected by the different environments more noticeably with certain characters than with others. The correlations between total weight of kernels and average weight of kernel and between the average length of culm and the average weight of kernel were higher in Montana than in New York. Certain correlations were found to be high and stable, while others were very unstable, being affected equally by environment either in the same locality in different years or in widely different localities. Correlations obtained with the plants grown from imported seed tended in general to agree rather closely with those from plants from home-grown seed. As a general conclusion, environment appeared to be more important than source of seed.

The method of selecting quick-ripening varieties of oats [trans. title], A. V. SOSNIN (*Nauch. Agron. Zhur. (Jour. Landw. Wiss.), 4 (1927), No. 5–6, pp. 388–396*).—A series of correlation studies in oats was conducted with the purpose of selecting early-maturing varieties. Observations on many varieties showed that the period from germination to heading and the period from heading to ripening are not proportional, even in varieties with the same total vegetative period, i. e., there is a difference in the length of one or the other period in varieties with an equal total period of growth. For this reason the two periods served as the basis for the correlation coefficients determined for different agronomic characters in this study. The first period varied from 34 to 62 days and the second period from 55 to 71 days.

Registration of varieties and strains of oats, III, T. R. STANTON, H. H. LOVE, and E. F. GAINES (*Jour. Amer. Soc. Agron., 20 (1928), No. 12, pp. 1323–1325*).—Iogold oats, approved for registration (E. S. R., 58, p. 532), is described, with a record of its performance.

Effects of dehulling seed and of date of seeding on germination and smut infection in oats, B. B. BAYLES and F. A. COFFMAN (*Jour. Amer. Soc. Agron., 21 (1929), No. 1, pp. 41–51, fig. 1*).—The effects of dehulling seed oats and of date of seeding on germination, infection by covered smut, and percentage of plants reaching maturity were studied cooperatively by the Oregon Experiment Station and the U. S. Department of Agriculture at Moro, Oreg., in 1925 and 1926.

Dehulling reduced the germination of uninoculated seed 5.8 per cent and of inoculated seed 10.6 per cent in 1926. When seed was dehulled but not inoculated 6.3 per cent of the plants failed to reach maturity, as compared with 11.1 per cent with inoculated seed. In 1925 the average smut infection in 47 hybrid strains of Markton×Scottish Chief was 5.4 per cent in plants from hulled seed and 17.1 per cent in plants from dehulled seed. Similarly, in 1926, with Early Champion and Sixty-Day, susceptible varieties, infection increased from 45.6 per cent in plants from hulled seed to 85.4 per cent in plants from dehulled seed. Plants from dehulled uninoculated seed of Early Champion and Sixty-Day were 3.2 per cent smutted, and those from dehulled inoculated seed were 85.4 per cent smutted in 1926 and from hulled seed of these varieties 1.2 and 45.6 per cent, respectively. Inoculation resulted in a mean reduction of 6 per cent in the emergence of dehulled seed and a reduction of 1.2 per cent in hulled seed.

Higher germination percentages were obtained from oats sown at earlier dates, while a larger percentage of plants which emerged reached maturity from sowings made on the later dates. The percentage of infected plants was much greater from seed sown on dates when the mean temperatures were high than when they were lower.

Proliferation in Poa bulbosa, P. B. Kennedy (*Jour. Amer. Soc. Agron., 21 (1929), No. 1, pp. 80–91, figs. 4*).—The habitat, occurrence in the United States, botanical characteristics, peculiarities of proliferation, growth habits, and economic worth of *P. bulbosa* are set forth briefly in this contribution from the California Experiment Station. Analyses by B. A. Madson tabulated in comparison with those of other grasses show that the bulbils and hay of *P. bulbosa* are nutritious feed for stock. The grass evidently has possibilities for forage on the range and in lawns and golf courses.

Relative productivity of seed potatoes grown under various controlled environmental conditions, H. O. Werner (*Jour. Agr. Research [U. S.], 38 (1929), No. 7, pp. 405–410*).—Experiments at the Nebraska Experiment Station with normal, healthy stocks of Triumph seed potatoes showed that while the soil temperature and also soil texture influenced the shape and appearance of the seed tubers, these factors did not have significant effects on their productivity. Yields from seed stocks produced upon soil containing high, medium, and low quantities of moisture did not differ enough to be of statistical importance.

Soil type and potato yields, J. H. Stallings (*Jour. Amer. Soc. Agron., 21 (1929), No. 1, pp. 69–75*).—A marked relationship was observed at Penney Farms, Florida, between soil type and potato yields for the spring and autumn of 1927. Portsmouth and St. Johns soils were far superior to either the Norfolk, Leon fine sand, or Blanton types for potato production. Extremely heavy rainfall during the latter half of April, 1928, favored the more droughty Norfolk and Blanton soils rather than the heavier Portsmouth and St. Johns. Potatoes on the last two types were damaged severely by the excessive rains in April, although the Portsmouth soil produced the greatest yields of all the types used, even during this wet season.

Seed potato certification in Pennsylvania, K. W. Lauer (*Penn. Dept. Agr. Bul. 471 (1929), pp. 15, figs. 6*).—Information is given on agencies administering certification service in the several States and in Canada, inspection and certification standards, standard grades for seed potatoes, and factors and important diseases affecting certification.

Physiological shrinkage of potatoes in storage, C. O. Appleman, W. D. Kimbrough, and C. L. Smith (*Maryland Sta. Bul. 303 (1928), pp. 159–175, figs. 4*).—The experiments recorded dealt with the variation in the rate of physiological shrinkage of potatoes because of structural and physiological changes in the tubers during different periods in their storage life. The actual loss in weight of potatoes on account of respiration was very small compared with the loss in weight due to evaporation of water, even at the fairly high temperature at which respiration tests were made. Physiological shrinkage was considered entirely as to water loss, although it included the slight shrinkage by respiration. The rate of water loss was compared for selected lots of potatoes at intervals with the current rate of evaporation from porous clay atmometers. Any deviation of these ratios from a constant was considered due to internal changes affecting the transpiration rate of the tubers. The principal observations in these studies have been noted earlier (E. S. R., 60, p. 330).

The higher shrinkage rate of immature potatoes during early storage declined rapidly, and by midstorage practically no difference existed between the

shrinkage rates of immature and mature tubers, even under widely varying conditions. At very low temperatures immature potatoes lost water at a faster rate for a longer period, probably because of delayed cork formation at low temperature. Potatoes apparently fully mature when dug lost water, especially during early storage, more rapidly at very low temperatures than at higher temperatures, even though the saturation deficits were greater at the higher temperatures. The actual shrinkage rates of potatoes kept under constant temperature and humidity conditions showed the same general trend as that indicated by the transpiration-evaporation ratios.

Technic of rice hybridization in California, J. W. JONES (*Jour. Amer. Soc. Agron., 21 (1929), No. 1, pp. 35–40*).—The method used in the hybridization of rice at the Biggs, Calif., Rice Field Station is outlined, with comment on work elsewhere.

Soybean growing in North Carolina, C. B. WILLIAMS (*N. C. Agr. Col. Ext. Circ. 127, rev. (1929), pp. 19, figs. 5*).—Practical information is given on the merits, varieties, and environment and cultural needs of the soybean, its place in the cropping system, farm uses, and its worth as an oilseed crop.

Preliminary report on the experiments with sugar beets in Palestine, M. ELAZARI and L. PINNER (*Zion. Organ. Agr. Expt. Sta., Agr. Rec., 1 (1927), No. 1, pp. 95–144, pls. 6, figs. 7*).—Experiments in Palestine during a rather dry year showed yields from 17.5 to 24.4 tons of beets per hectare, and sugar contents of ripe beets varied from 19 to 20 per cent. While transplanting of beets seemed impracticable for extensive production, it outyielded sown stands. Bird pests and drought were prejudicial factors. It appeared possible that with irrigation beet yields could be insured and increased, and that sugar beets could be grown supplemental to sugarcane (E. S. R., p. 34).

The weight of sugar beet seed used per hectare [trans. title], E. SAILLARD (*Jour. Agr. Prat., n. ser., 51 (1929), No. 13, pp. 253, 254*).—Reduction in the average quantity of sugar beet seed used in France before the war, 25 kg. per hectare (22.25 lbs. per acre), to the postwar average of 20 kg. or less has paralleled a like reduction in stand from 72,000 beets per hectare to 62,000. Pointing out that other European countries use from 30 to 45 kg., the author suggests that French beet growers make comparative trials of 20- and 30- to 35-kg. seeding rates.

Thinning sugar beets, W. W. ROBBINS (*Calif. Agr. Col. Ext. Circ. 22 (1928), pp. 16*).—This circular emphasizes the necessity for care in the thinning of sugar beets, points out the need for instruction and supervision of labor, and discusses the time to thin, proper spacing, the value of selecting large seedlings, the influence of stand on yield, and the basic reasons for the different practices in the thinning operation.

Further notes on the P. O. J. canes in Louisiana, W. E. CROSS (*Facts About Sugar, 24 (1929), No. 15, pp. 350, 351*).—From his experience with the P. O. J. sugarcanes in Argentina the author suggests that P. O. J. 36 might well be the principal cane grown in Louisiana, that only the healthiest, most vigorous, and reddest or most purple canes be chosen and only freshly cut cane be used for planting, that closer planting be tried, that fertilizer be used with care, that the possibility of irrigation be considered, that the cane be ground soon after cutting, that the P. O. J. canes keep better standing after frost than when cut and in windrows, and that efforts should be made to get the cane to give good stubble yields for at least four or five years.

The comparative value of scarified and unscarified sweet clover seed, C. W. LEGGATT (*Sci. Agr., 9 (1929), No. 9, pp. 611–614*).—Seeded in the field at normal rates sweetclover seed unscarified produced at Lacombe, Alta., about 20

per cent fewer plants but did not differ much in yield from scarified seed, while at Brooks, Alta., stands were similar, although the unscarified seed outyielded the scarified seed by 83.5 per cent. Plants from unscarified seed were the more thrifty and vigorous. Hardseededness apparently was not a factor limiting stand. See also earlier notes (E. S. R., 59, p. 627).

Recommendations with reference to fertilization of tobacco grown on average soils in Virginia, North Carolina, South Carolina, and Georgia during 1929, C. B. WILLIAMS ET AL. (*Jour. Amer. Soc. Agron., 21 (1929), No. 1, pp. 109, 110*).—Analyses, rates, and nutrient sources are indicated for fertilizers for bright flue-cured and dark (sun-cured and shipping) tobacco.

Shedding of kernels as a heritable character in wheat [trans. title], S. LEWICKI (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Pulawach (Mém. Inst. Natl. Polon. Écon. Rurale Pulawy), 9 (1928), No. 1, pp. 19–31, figs. 2; Eng. abs., pp. 30, 31*).—Weak insertion of wheat kernels in the glumes (*W*), resulting in excessive shedding when maturing, appeared to be a varietal rather than a species characteristic. The glumes of varieties shedding mature kernels are more or less parted, the degree of parting being characteristic of the variety and hereditary. Weak insertion of kernel was dominant in F_1, whether the cross included an awned or awnless wheat, and in most cases appeared in F_2 in three plants to one not shedding, although three factors seemed involved in one case. While weak insertion and awns did not seem to be linked in inheritance, yet in F_2 bearded wheat was characterized by a much greater tendency to shed kernels.

A comparative study on the Sandomierka and Wysokolitewka varieties of winter wheat [trans. title], S. BARBACKI (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Pulawach (Mém. Inst. Natl. Polon. Écon. Rurale Pulawy), 9 (1928), No. 1, pp. 252–282, figs. 2; Eng. abs., pp. 280–282*).—Biometrical studies of the Sandomierka and Wysokolitewka varieties (*Triticum vulgare*) of winter wheat during seven years gave considerable data of agronomic interest. The analyses of both varieties showed negative correlations between length of spike and density of spike, density of spike and length of straw, and length of straw and resistance to lodging, and positive correlations between spike length and straw length, and spike density and resistance to lodging. In the varieties and conditions of the study a longer, laxer spike was accompanied by a greater yield, a more profitable grain : straw ratio, and a better quality of grain.

Registration of improved wheat varieties, III, J. A. CLARK, J. H. PARKER, and L. R. WALDRON (*Jour. Amer. Soc. Agron., 20 (1928), No. 12, pp. 1318–1322*).—Additional varieties of wheat approved for registration (E. S. R., 58, p. 533) and described briefly included Oro, Garnet, Reward, and Nabob.

The effect of cutting Garnet wheat at different stages of maturity and on consecutive dates after the occurrence of frost, G. E. DELONG (*Sci. Agr., 9 (1929), No. 9, pp. 566–574*).—Studies on Garnet wheat, grown at the Lacombe, Alta., Experimental Station and cut at different times between the late milk and the firm dough stage and also frosted on different dates, showed that this variety could be cut as early as the medium dough stage in a season with cool harvesting weather without sacrificing too much quality and yield. It was observed that frost damage interrupts and prevents the continuance of the translocation of materials to the kernels, to an immature kernel tends to reduce in quantity those materials making up the kernel, reduces the grade of immature wheat, and is cumulative and tends to increase from day to day as long as there is moisture in the kernel. Frosted grain evidently should be harvested as soon as possible after the occurrence of frost.

Commercial agricultural seeds, 1928, J. M. BARTLETT ET AL. (*Maine Sta. Off. Insp. 130 (1928), pp. 85–113*).—The purity, germination, and weed seed

content are tabulated for 405 official samples of agricultural seed collected in Maine during 1928.

The principles of compounding mixtures of grass and clover seeds, A. Volkart (*Sci. Agr., 9 (1929), No. 8, pp. 510–521, figs. 12*).—In selecting species for a grass and clover mixture, the purpose, duration, climate and soil, tillering, time of sprouting, ability to thrive in mixture, and endurance to unfavorable conditions are indicated as important. Principles derived from experiments at Oerlikon, Switzerland, are discussed briefly.

The most important noxious weeds of Oregon, H. M. Gilkey and G. R. Hyslop (*Oreg. Agr. Col. Ext. Bul. 412 (1929), pp. 56, figs. 21*).—The general characteristics, dissemination, and harmful attributes of weeds are summarized, and individual descriptions and control methods are given for 21 of the most troublesome weeds in the State.

The eradication of Antidesma, E. B. Martyn (*Agr. Jour. Brit. Guiana, 2 (1929), No. 1, p. 52*).—*A. ghesaembilla*, a plant escaped from cultivation, proved to be a rather troublesome weed. A 10 per cent solution of sodium arsenite poured into auger holes in the trunk was effective, especially when the tree was cut and the stumps so treated. New suckers appearing after cutting back and sprayed when from 6 to 12 in. high were killed after four applications of a 1 per cent solution of sodium arsenite.

Goat grass or wild wheat (Aegilops triuncialis), P. B. Kennedy (*Jour. Amer. Soc. Agron., 20 (1928), No. 12, pp. 1292–1296, fig. 1*).—Goat grass or wild wheat (*A. triuncialis*), an annual occurring as a weed on grazing lands and slowly spreading to cultivated areas in California, is described as very injurious to livestock because of its very pointed fruits. Control methods suggested are avoidance of grazing while the heads are mature to prevent dissemination, and sterilization of the soil containing the seeds by heavy applications of salt, oils, arsenicals, or sodium chlorate. A careful system of clean fallow and cutting the cereal crop for hay when quite young might eradicate wild wheat occurring on grain land.

Magnesium and calcium chlorate as substitutes for sodium chlorate for killing field bindweed, W. L. Latshaw and J. W. Zahnley (*Jour. Amer. Soc. Agron., 20 (1928), No. 12, p. 1329*).—Further experiments (E. S. R., 59, p. 137) at the Kansas Experiment Station showed that magnesium chlorate and calcium chlorate could be used as substitutes for sodium chlorate in the control of field bindweed. They lack the fire hazard of sodium chlorate and are more hygroscopic.

Chemical weed killers, S. H. Vigor (*Sci. Agr., 9 (1929), No. 9, pp. 587–593*).—The effects of iron sulfate, sodium arsenite, sulfuric acid, sodium chlorate, and copper nitrate in killing weeds are reviewed, with statements of observations by the field crops branch of the Saskatchewan Department of Agriculture.

HORTICULTURE

Horticulture, G. W. Hood (*Philadelphia: Lea & Febiger, 1929, 3. ed., rev., pp. IX+17–382, figs. 156*).—The third revision of an earlier noted publication (E. S. R., 45, p. 93).

[Horticultural investigations at the New Mexico Station] (*New Mexico Sta. Rpt. 1928, pp. 16, 31–40, 41, 42, fig. 1*).—Studies upon the removal of arsenical residues from apples indicated that either washing with dilute hydrochloric acid or wiping may be resorted to successfully. Observations on cider and vinegar made from uncleaned apples suggested that these by-products may fail to meet food law requirements unless the fruit is cleaned.

Low temperatures, reaching 22° F. in one case, were again responsible (E. S. R., 59, p. 231) for destroying the fruit crop. Rome Beauty escaped with a fair crop by virtue of late-opening buds. The dates of blooming are given for several fruits.

A comparison of field seeding and of transplanting tomatoes showed but little difference in maturity. Western yellow blight was not a factor in either planting. The long continued fertilizer experiment with cabbage again showed the value of nitrogen fertilizers for this crop, the highest computed acre yield being secured from cottonseed meal in one case and from ammonium sulfate in another. The detrimental effect of shade on cabbage production was shown in estimated yields of 22,016, 19,000, and 12,720 lbs. per acre, respectively, for unshaded, partially shaded, and heavily shaded sections of the experimental field. The cutting of the competing tree roots offset in part the detrimental effect of the trees. Premature shooting to seed was prevalent in the cabbage fields.

Records are given of the 1927 yields of varieties of pecans and Persian walnuts. Acre yields are given for Muscat, Mission, Thompson Seedless, and Cornichon grapes included in the duty of water project. Attempts to grow a fall crop of garden peas by planting in late July met with failure due to poor germination. Los Angeles market lettuce planted August 30 grew well and yielded a crop on November 26. Heavy soils rich in organic matter are suggested for lettuce. The results of trials with miscellaneous vegetables and ornamentals are discussed.

Frost and the prevention of frost damage, F. D. YOUNG (*U. S. Dept. Agr., Farmers' Bul. 1588 (1929), pp. [2]+62, figs. 39*).—This is a revision of and supersedes Farmers' Bulletin 1096 (E. S. R., 43, p. 237).

Opening with a general discussion of the nature and causes of frost and the influence of land contour, soil moisture, ground covers, etc., on frost occurrence, the author follows with a comprehensive discussion of frost protection. The three principal means of protection, namely, covering to conserve heat, mixing and stirring the air, and the addition of heat, are considered, with principal stress on the last, which is deemed the only practical large scale method. The success of orchard heating is said to lie primarily in the fact that on cold, clear, calm nights there is usually a low ceiling of warm air which prevents the rise of the heated air, thus confining it to the lower stratum where needed. Small orchards are more costly to heat per unit area because of the drift of air, even on calm nights. That smudging has no disastrous influence on pollination was indicated in a fine set of pears on trees that were smudged every night during the blooming period.

Orchard heating practices are discussed in detail, with remarks on the type of heaters, fuels, placement in the orchard, filling, lighting, care, etc. The economic phases are considered and data presented on the critical temperatures for various fruits in various stages of development. The types of injury resulting from frost are illustrated and discussed, and various instruments useful in determining humidity and temperature are described.

Insecticides and fungicides, 1928, J. M. BARTLETT ET AL. (*Maine Sta. Off. Insp. 130 (1928), pp. 114–116*).—The results of the analyses of samples of insecticides and fungicides received from the commissioner of agriculture in 1928 are presented in tabular form.

Use of paper mulch in vegetable growing, H. C. THOMPSON (*Market Growers Jour., 44 (1929), No. 5, pp. 192, 193*).—A brief account of experiments at the New York Cornell Experiment Station with paper mulch applied to tomatoes, cabbage, beans, potatoes, and beets. Except with the beet, the yields were consistently larger on the paper mulch than on the cultivated plats.

The culture of onions in Indiana, H. D. BROWN (*Indiana Sta. Circ. 158 (1928), pp. 36, figs. 16*).—A general discussion on soil preparation, the use of fertilizers, seeding practices, varieties, cultivation, harvesting and curing, the growing of onion sets and of onions from sets, the control of pests, etc.

Cold storage of onions, W. J. WILLIAMS (*Agr. Gaz. N. S. Wales, 40 (1929), No. 1, pp. 43, 44*).—In experiments conducted at the Municipal Cold Storage Works, Sydney, N. S. Wales, Brown Spanish onions stored at 29° F. were found to keep in excellent condition for 3 months, and if gradually defrosted were in excellent shape for use. The weight loss in cold storage was about 4 per cent as compared with 12 per cent in ordinary storage. The Silver Skin variety was more susceptible to injury in the defrosting process.

Fruit-growing in South Africa, R. A. DAVIS (*[Johannesburg]: So. Africa Cent. News Agency, 1928, pp. 532, figs. 72*).—A general discussion from the commercial viewpoint.

A preliminary report upon the production of seedling fruit stocks, H. B. TUKEY (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 158–161*).—A report on three seasons' work with rootstocks at the New York State Experiment Station.

The necessity of afterripening hardy fruit seeds in order to secure satisfactory germination was determined. Domestic supplies of seed generally proved superior to imported stocks. Seed from mature fruits proved superior to that from immature fruits. Seed of Baldwin, Rhode Island, and Tompkins King gave low germination and weak seedlings, while that of Winesap, Wealthy, Ben Davis, Delicious, and Rome proved valuable. Crossing McIntosh with Baldwin, Rhode Island, and Delicious, it was found that only Delicious gave good viable seed. Bartlett, Anjou, Garber, Kieffer, Sudduth, and Winter Nelis pears yielded strong viable pollen.

Adequate spacing of seedlings in the row greatly increased the proportion of larger sizes. For example, Mahaleb with 4 plants per foot yielded 14.98 per cent of seedlings 0.25 in. or over, while with 10 plants per foot it yielded only 0.22 per cent of this grade. The benefit of regular spacing was also shown in the case of apple seedlings, where thinning greatly increased the proportion of larger seedlings. Fertilizers gave no consistent response upon Mahaleb seedlings.

Varieties and species varied markedly in the root branching habit; for example, Whitney and *Malus baccata* produced a high proportion of straight roots, while Winesap produced many well-branched roots. Tests of various planting practices favored the planting board method. The best pear and apple seedlings were produced with transplanting and planting boards. Transplanting, on the other hand, had little or no influence on Mahaleb, Mazzard, and Myrobalan seedlings, except that in certain cases it was possible to bud transplants the first season. The 2-year method of growing seedlings gave better results than no treatment, but was not as favorable as transplanting. Cherry stocks were easily injured by premature digging and careless handling.

The Japanese apricot as a root-stock, C. O. SMITH (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 183–187*).—Finding at the Citrus Experiment Station, Riverside, Calif., that *Prunus mume* was highly resistant to inoculations with crown gall organisms, seedlings of this species were budded with five commercial varieties each of peach, almond, Japanese plum, prune, and apricot, with the aggregate result that *P. mume* is deemed of little promise as a rootstock for any of the stone fruits except apricot. The behavior of the various varieties on the stock is reported in detail. It is believed that better success may result when an interstock compatible with *P. mume* and the top scion is used.

New wraps for buds and grafts, J. A. McCLINTOCK (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 175, 176*).—A discussion of the merits and demerits of two

comparatively new types of wrapping material, namely, adhesive tape and rub ber strips. The latter are regarded favorably because of the success obtaine in their use and their tendency to break apart before girdling or other injur results.

The pollination of orchard fruits in Michigan, R. E. MARSHALL, S. JOHNSTON, H. D. HOOTMAN, and H. M. WELLS (*Michigan Sta. Spec. Bul. 188 (1929) pp. 38, figs. 29*).—Supplementing evidence obtained in Michigan with that fron other States, the authors present a general discussion of the pollination probler as related to the apple, pear, peach, cherry, and plum. Of 10 varieties of apple namely, Baldwin, Delicious, Duchess, Grimes, Hyslop, Jonathan, McIntosh Northern Spy, Rhode Island, and Wealthy, none was found sufficiently self fertile to justify planting in solid blocks. No case of intersterility was ob served in the apple, although Baldwin and Rhode Island proved to be unsatis factory pollinizers. Delicious and Steele Red were exceptionally good polli nizers, and Jonathan, Wealthy, Duchess, McIntosh, Grimes, and Northern Spy are rated as effective. Only on rare occasions, and then in the case o early and late bloomers, such as Duchess and Northern Spy, did the bloomin periods fail to overlap sufficiently to allow for pollination.

In the case of pears, Flemish and Conference were the only varieties found commercially self-fertile and together with Howell and Bosc are listed a effective pollinizers for other kinds. Bartlett and Seckel were found to b intersterile. The blooming periods of all of the pears tested overlap sufficientl to allow for cross-pollination.

The J. H. Hale peach, as previously reported (E. S. R., 52, p. 443), was self sterile, and Late Crawford, Belle of Georgia, Greensboro, Red Bird Cling Rochester, St. Johns, and Salway produced unsatisfactory crops when self-polli nated. South Haven and Kalamazoo were satisfactory pollinizers for J. H Hale, with Elberta and Banner not fully satisfactory.

Cherries of the sour group were generally self-fertile and those of the sweet type self-sterile. Bing, Lambert, and Napoleon were intersterile, but Windsor, Schmidt, and Bing, commonly grown in Michigan, were interfertile. Sour cherries were not found satisfactory pollinizers for sweet varieties.

Cross-pollination is conceded advisable in the case of European plums despite considerable self-fertility in this group. No evidence of intersterility was found in the European plum. The Blue Damson was self-fertile. Burbank and Abundance, although self-sterile, made a dependable pair for interplanting. European and Japanese plums were practically intersterile, suggesting the uselessness of interplanting. Various measures for increasing the set of fruit are discussed, including the introduction of bees and of limbs of compatible varieties.

The crab-apples and nectarines of Japan, Y. ASAMI (*Tokyo: Marquis Nabeshima, 1927, pp. [5]+89, pls. [94]*).—A contribution to the systematic botanical and pomological knowledge of fruit trees cultivated in Japan.

The vigor of apple seedlings, F. E. GARDNER (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 162–164*).—In studying at the University of Maryland the effect of various pollen parents on the vigor of Delicious apple seedlings, it was evident that the male parent exerted a profound influence on the vigor of the progeny as measured in height growth the first and second years. Arranged in descending order of potency the following nine pollen parents, namely, Northwestern Greening, Williams, Jonathan, McIntosh, Rambo, Rome, Yellow Transparent, Grimes, and Gano, were used. Records taken the second year upon the growth of the seedlings following severe cutting back in the spring showed much the same order, Gano being at the bottom of the list in both years. The coefficients of odds between the most vigorous and the least vig-

orous groups in the two years were 11.65 and 7.95, respectively. The male parent also influenced variability, since the several progenies were less variable than the entire group.

Variability of vigor in apple seedlings, G. H. DICKSON (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 165–168*).—That the age of a variety, as measured in the number of years from origin, may have an influence on the potency in transmitting vigor to the seedlings was suggested in studies at the Vineland Station, Canada, in which records were taken on seed content and seed germination in some 59 varieties of apples.

The influence of clone roots on the variability of young apple trees, R. D. ANTHONY and G. E. YERKES (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 169–171*).—Comparisons at the Pennsylvania Experiment Station of the growth of Stayman Winesap trees on French crab roots and on roots of a selected clonal stock showed the commercial French crab lot to maintain its initial superior uniformity at the end of the second growing season.

Records taken at Arlington Experiment Farm, Virginia, on the height of 1-year Winesap trees budded on French crab, on open pollinated seedlings of commercial varieties, and on clones of American selection showed coefficients of variability of 14 ± 0.65, 17 ± 0.96, and 12 ± 1.07, respectively. McIntosh seedlings worked on the same groups of rootstocks gave coefficients of variability of practically the same order, indicating that the use of clonal rootstocks apparently had reduced variability in scion growth. Data taken on a lot of Stayman Winesap trees worked on the same three types of roots also showed the most uniform growth on the clonal roots. Differences in uniformity were also observed between lots of trees grafted on seedlings of known ovule parentage.

Responses of variety and seedling roots to attempts at propagation, W. H. UPSHALL and F. E. GARDNER (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 172–174*).—Marked difficulty was experienced by the authors in an attempt to secure own-rooted trees of some 50 apple varieties by the root-cutting method of propagation which has been successfully utilized by Yerkes (E. S. R., 58, p. 538) in the case of seedling apples. Of 4,079 cuttings of commercial varieties only 3.28 per cent rooted, as compared with 81 per cent for 337 cuttings of French crab seedling roots. Unfavorable results were also obtained when the commercial variety roots were used in bench grafting. Of the few varietal root cuttings that did grow, some produced sufficient roots for further propagation, and in this case 42.9 per cent of successful rooting was secured, indicating the possibility of developing vigorous rooting strains. The authors believe that the difference in behavior of seedling and scion roots lies in their different anatomical origin, the seedling roots coming from the true root tissue of the seed and the scion roots presumably arising in the cambium.

A proposed control method for crown gall and callus knot on apple in the nursery, T. J. MANEY and B. S. PICKETT (*Natl. Nurseryman, 37 (1929), No. 2, pp. 6, 7, 8, 12, 13, figs. 4*).—Noting that a considerable proportion of the so-called crown galls on nursery stock were simply overgrowths of callus tissue, the authors studied various propagation practices with the view to eliminating this factor. A modified tongue graft, described and illustrated, was found when wrapped with adhesive tape to reduce greatly the percentage of imperfect trees. Hairy root knot is deemed to be for the most part an inherent genetic character in the tree and not a pathological phenomenon.

The effect of height of head on young apple tree growth and yield, H. L. CRANE (*West Virginia Sta. Bul. 214 (1928), pp. 19, figs. 2*).—Records taken on the growth and fruiting of Rome and Stayman Winesap apple trees pruned at

the time of setting to 1-, 2-, 3-, 4-, and 5-ft. trunks showed the maximum growth in the low-headed trees and earlier fruitfulness as indicated by blossom counts in the high-headed trees. The 1-ft. trees, with one possible exception, made significantly greater annual growth than the taller trees, and although more wood was removed in pruning the percentage removed was actually lower. From the 2- to 5-ft. heights the percentages of wood removed were strikingly similar. Records of the weight of wood removed in certain years show a much larger amount in the case of the Rome variety for the 1-ft. trees, with but little difference in Stayman Winesap in the 1-, 2- and 3-ft. groups. Circumference measurements show the greatest total increase in the case of 1-ft. trees, the increase diminishing with the height of the head. Very little difference was found in the actual height of the trees in the several groups, but in respect to volume the 1-ft. Rome trees were strikingly larger, with similar but less contrasting differences in the Stayman Winesap. Flower and fruit records were rather inconsistent due to the youth of the trees. The high-headed trees were the first to bear, but it is suggested that the low trees because of their greater size will eventually produce more fruit.

Non-bearing of Rome Beauty apple trees, E. Leishman (*Jour. Dept. Agr. So. Aust., 32 (1929), No. 6, pp. 556–558*).—Of several practices, namely, light pruning, root pruning, pollination, and girdling, compared in a 2,000-tree block of Rome Beauty apples in South Australia, pollination was the only practice to give substantial results. Girdling and root pruning were apparently slightly deleterious.

The First Commercial Congress on Table Apples, edited by E. Poher and A. Chavard (*I. Congrès Commercial de la Pomme de Table, Bourges, 1926. Mémoires et Comptes-Rendus. Paris: Compagnie d'Orléans, 1927, pp. XIII+519, figs. 173*).—This congress held at Bourges, France, June 26 and 27, 1926, considered various aspects in the commercial production of table apples. One paper, entitled The Principal Commercial Varieties of Table Apples, by Chasset (pp. 91–120), contains systematic descriptive notes.

Importance of leafspot in the selection of pear varieties used as stocks for budding, J. A. McClintock (*Amer. Soc. Hort. Sci. Proc., 25 (1928), p. 177*).—*Pyrus communis*, *P. serotina*, and *P. ussuriensis* seedlings were found under Tennessee conditions to suffer severely from defoliation by various leaf spot diseases, while in marked contrast *P. calleryana* and *P. betulaefolia* grew until stopped by cold weather.

Pollination study of the Anjou pear in Hood River Valley, G. G. Brown and L. Childs (*Oregon Sta. Bul. 239 (1929), pp. 15, figs. 7*).—Observing a decided tendency in the Anjou pear toward imperfect setting of the fruit, pollination studies were conducted in 1927 and 1928 to determine the degree of self-sterility in this variety and desirable pollinizers. Determinations of viability of four pollens, namely, Bartlett, Easter, Fall Butter (White Doyenne), and Anjou, in a 12 per cent sugar solution showed 61.4, 33.1, 44.9, and 34.8 per cent, respectively, in a 7-day period. The Fall Butter pollen was noticeably superior in rapidity of germination and vigor of growth. Attempts to spray pollen upon the pistils gave inconclusive and negative results, partly because pollen did not mix well with water and partly because of poor growth when submerged. The fertilization of Anjou blooms was successfully effected both in cold, rainy weather and on warm, favorable days when the pollen was applied directly to the stigmas, leading to the suggestion that failure to set in inclement weather is likely due to the inability of the pollen of compatible varieties to reach Anjou flowers. In 1927 emasculated Anjou blooms brushed with Easter, Bartlett, and Anjou pollens set 38.3, 32.4, and 8.3 per cent,

respectively. In 1928 under the same environmental conditions Easter, Bartlett, Fall Butter, and Anjou pollens yielded 16.8, 16.5, 24.8, and 0 per cent of set. These records indicate that Anjou is practically self-sterile but may be pollinated with Bartlett, Easter, or Fall Butter, preferably the first two because of their commercial importance.

Planting plans providing for suitable pollinizers for the Anjou pear are presented, together with suggestions that at least one strong colony of bees be placed in each acre of pears to insure the cross transfer of pollen.

Removal of spray residue from pears and apples, 1929 fruit season, F. W. PETTEY (*So. African Fruit Grower and Smallhold., 16 (1929), No. 2, pp. 34, 35, 44, figs. 2*).—A discussion of the use of the hydrochloric acid treatment for the removal of spray residues.

The Gage peach, H. W. ANDERSON and M. J. DORSEY (*Jour. Heredity, 20 (1929), No. 3, pp. 119–125, figs. 5*).—The growth and fruiting characteristics of an Elberta-like peach are discussed in considerable detail, with comments on the possible origin of the variety, its relatively high resistance to bacterial infection, and its general desirability.

A study of the hardiness of the fruit buds of the peach, H. E. KNOWLTON and M. J. DORSEY (*West Virginia Sta. Bul. 211 (1927), pp. 28, figs. 2*).—Observing that winter injury to the peach in West Virginia is almost entirely confined to the buds, a study was made in the spring of 1923 of the injury to buds of trees in the variety orchard. The range of killing was from 0 per cent in Late Crawford to 100 per cent in Reeves, with Elberta 47.2 per cent. In addition to winterkilling, dead pistils were found in all of the varieties this year, especially in Late Crawford and Carman. In respect to relative hardiness of buds on different types of shoots, considerable varietal differences were noted. In Elberta killing was greater on the short laterals in the interior, while in Belle and Late Crawford there was slightly more loss on the outer terminals. Following the severe winter of 1924-25 the few living buds were located either on spurs or at the base of terminals. Records taken in different parts of the State showed much less injury east of the mountains.

Determinations of the date of cessation of the rest period, as indicated by the date of bloom of cut branches brought into a greenhouse, showed Elberta to come out of the rest period slightly before Rochester and Belle. The exact date of the cessation was not established. It is believed that the early cessation of rest in the peach renders the buds susceptible to weather changes during winter. Cytological studies of fruit buds of the Elberta, Rochester, and Belle varieties showed that pollen development proceeds from early December through the winter, anther changes affording a sensitive index to growth changes. Considerable variation was noted in the comparative development of fruit buds on different parts of the trees by midwinter, as measured by the degree of pollen differentiation. Generally the buds on the bases of the terminal twigs were latest in development, those on the middle next and terminal buds farthest advanced. The buds of short spurs or branches on the interior of the trees were slightly more advanced on the average than the basal buds of the outside terminals. Ovule development was first evidenced on January 3 by the development of growing points on the carpel wall. Differentiation of the integuments was noticed on March 3. Megaspore mother cells were not found in flowers just about to open, indicating that the embryo sac is not formed until after the first flowers bloom.

Some evidence was obtained in the case of 8-year-old trees that nitrate of soda may under certain conditions increase the hardiness of peach buds.

Peach pruning, F. P. Cullinan (*Indiana Sta. Bul. 326 (1928), pp. 32, figs. 18*).—A general discussion upon peach pruning based on studies conducted in Knox County in which three distinctive types of dormant pruning, (1) light heading and thinning, (2) severe heading and thinning, and (3) renewal thinning or cutting back of the terminal shoots, were compared on young Elberta and J. H. Hale trees. Severe heading resulted in the production of long terminal shoots averaging over 36 in. in length and bearing slender laterals with few fruit buds and also in dense foliage which shaded the interior of the tree and greatly decreased fruit bud formation. On the other hand, trees receiving light heading back to laterals and thinning produced terminals about 24 in. long with numerous stocky laterals well supplied with fruit buds and with open heads which allowed the entrance of adequate sunlight.

In 1922, the second season of the experiment, all trees set a heavy crop of fruit, the average yields being 222.7, 245, 203, and 282.5 lbs. per tree for the light headed, renewal thinned, severe headed, and nonheaded trees, respectively. Yield differences in 1923 were even more significant.

As regards variety, it was found that the J. H. Hale was not as productive or as vigorous as the Elberta. The importance of fruit thinning was indicated in increased size of fruits on the thinned trees.

Graft affinity tests with peach on Myrobalan and Marianna plums, W. L. Howard and M. J. Heppner (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 178–180*).—Great variation was noted among types of Myrobalan and Marianna stocks in their affinity with the peach and incidentally among peach varieties in their ability to thrive on these stocks. Peach buds apparently united successfully with both stocks and made rapid growth until about August of the first year when many died suddenly, apparently from root starvation.

Observation on Mayflower peaches budded on several lots of Myrobalan showed certain lots to ripen their fruits fully two weeks earlier than normal. Others were two weeks later than normal.

Studies in strawberry bud differentiation, H. Hill and M. B. Davis (*Canada Dept. Agr. Bul. 110, n. ser. (1929), pp. 15, figs. 38*).—Cytological studies at the Dominion Experimental Farms, Ottawa, upon the flower buds of Pocomoke strawberry plants of recorded dates of rooting showed the first signs of differentiation on September 19 in those lots rooted from July 25 to August 22. Although runners 2 weeks of age on September 19 showed no signs of differentiation, those rooted after this date did give evidence when only 2 weeks old. Runners rooted September 12 and 19 and October 10 began differentiation on October 1, 10, and 24, respectively. Apparently the stimulus necessary for flower bud formation was lacking irrespective of the age of the plant before September 19, a date substantially the same for three consecutive years of the study.

The first morphological indications of flower bud formation were the pushing up and flattening out of the crown. In the case of plants showing first signs September 19, there were evident on October 10 three growing points destined to develop into a primary and two secondary flowers. On October 17 the primary bud possessed sepal, petal, and stamen primordia, and the secondary sepal and petal primordia. By October 31 the primary buds were quite well developed, showing both pistil primordia and prominent anthers.

The observations are believed to explain the results of studies upon the effect of fertilizers on fruit bud differentiation, namely, that fertilizers applied in the spring have had no effect in increasing the number of buds.

Investigations in rooting blueberry cuttings, S. Johnston (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 181, 182*).—Comparing German peat, American

peat, German peat and sand, and sand alone as rooting media for hard and soft cuttings of blueberry varieties, favorable results were secured at the South Haven, Mich., Substation with the two forms of peat. About the middle of July appeared to be the best time for taking softwood cuttings. This date coincided with the stage that secondary growth started from lateral buds of the new shoots. Softwood cuttings taken August 23 failed to root to any extent and formed flower buds. Cuttings treated with various chemical stimulants before placing in German peat showed no consistent differences in rooting ability that could be attributed to treatment.

The origin and development of cranberry culture in the Netherlands [trans. title], J. W. van Dieren (*Nederland. Kruidk. Arch., Nederland. Bot. Ver., 1928, No. 2, pp. 82–129, fig. 1*).—A general discussion.

The olive and the olive growing regions of the Union of Socialistic Soviet Republics [trans. title], V. A. Moniushko (Monjuschko) (Monjushko) (*Trudy Prikl. Bot., Genet. i Selek. (Bul. Appl. Bot., Genet. and Plant-Breeding), 21 (1928), No. 2, pp. 245–344, figs. 33; Eng. abs., p. 344*).—The author presents a discussion upon the distribution, early history, and present status of olive growing in the Union of Socialistic Soviet Republics.

FORESTRY

The use of alinement charts in constructing forest stand tables, D. Bruce and L. H. Reineke (*Jour. Agr. Research [U. S.], 38 (1929), No. 5, pp. 289–308, figs. 10*).—Following a preliminary discussion of certain better known methods of constructing forest stand tables, such as the use of probability paper and the plotting of frequency distributions, the authors discuss a graphic method based on alinement charts which is described as effective for both normal and skewed frequency distributions. It is pointed out that the relation between anamorphosis and alinement charts is generally little understood, but that any system of straight lines produced by anamorphosis may be transformed into an alinement chart. Data are presented upon the technic of preparing alinement chart stand tables and examples of their use given. It is pointed out that the methods given have proved successful in all cases in which they have been utilized, except with frequency distribution of volumes in board feet where the rigid lower limit of merchantability distorts the stands of smaller average diameter without affecting those which are larger.

Some results of thinning jack pine, T. S. Hansen and R. M. Brown (*Jour. Forestry, 27 (1929), No. 3, pp. 275–279*).—Pointing out that jack pine has gained rapidly in commercial importance in recent years and will probably always be a factor on the light, dry, sandy soils of the Lake States region, the authors report on the results of a thinning experiment established by the University of Minnesota in a stand 37 years old at the beginning of the experiment (1912–1914). Before thinning there were 590 trees per acre, a number believed to be 40 per cent below normal stocking. Of the original volume (26.4 cords) 7.6 cords were removed in thinning, but consisted chiefly of suppressed and intermediate trees. Records taken in 1922 showed a net gain of only 7 per cent after allowing for the loss from dead trees. At the same time there was no appreciable change in average diameter. Borings gave further evidence that the trees had not responded definitely to thinning, suggesting that increased growth in jack pine stands thinned after they are 40 years of age is problematical.

The root systems of Fraxinus excelsior L., F. pennsylvanica Marsh., and Acer negundo L. on the black soils of Kuban [trans. title], A. V. Gurskii (Gursky) (*Trudy Prikl. Bot., Genet. i Selek. (Bul. Appl. Bot., Genet.*

and Plant Breeding), *21* (*1929*), *No. 3*, *pp. 145–183*, *pl. 1*, *figs. 10; Eng. abs.*, *pp. 182, 183*).—At the North Caucasian Station of the Institute of Applied Botany, Union of Socialistic Soviet Republics, it was noted that *F. pennsylvanica* failed to grow as well as did *F. excelsior*. This is believed to be due to the lack of strong taproots in the former species, preventing the tree from drawing moisture from the damp layers of loess soil. The author remarks on the widely contrasting root variability between closely related species.

The testing of coniferous tree seeds at the School of Forestry, Yale University, 1906–1926, J. W. Toumey and C. L. Stevens (*Yale Univ. School Forestry Bul. 21* (*1928*), *pp. 46*, *pls. 2*, *figs. 4*).—Studies at the Yale University School of Forestry during the years 1906 to 1926 upon a total of 36 species of conifers, representing 11 genera, showed great variability in the viability of the seed. The lowest average germination (0.7 per cent) at the end of 50 days for any single species was found in the case of the yew, *Taxodium distichum*. The maximum average germination (74.1 per cent) was obtained in *Pinus maritima*. In white pine, *P. strobus*, 26 samples gave an average of 27 per cent viability after 50 days. A total of 24 of the 36 species showed no germination in some samples in this period.

In conclusion the authors emphasize the desirability of standard germination tests on forest seeds.

The precise expression of "dryness," C. G. Bates (*Science*, *69* (*1929*), *No. 1793*, *p. 497*).—From his studies with coniferous seeds the author concludes that the expression "air-dry" is entirely too vague for application to seeds in storage, since it may cover a range of relative humidity of from 60 to 20 per cent, which in turn may effect considerable differences in the moisture content of the seeds. The need is stressed of a precise method both of controlling and expressing the air-dry condition in living material.

DISEASES OF PLANTS

[Plant disease investigations] (*New Mexico Sta. Rpt. 1928*, *pp. 18, 19, 21, 22*).—In continuation of previous reports (E. S. R., 59, p. 237), irrigating peppers at intervals of 21 days and ridge cultivation appeared to reduce the number of chili pepper plants that died from wilt and increased the total yield of the crop.

All attempts to discover an organism connected with apple measles gave negative results. The variety Jonathan is said to be most subject to measles in New Mexico, and it also shows three types of the disease. Ben Davis and Winesap are said to be only slightly affected. The soil taken from about diseased trees had a content of 0.434 per cent of soluble salts, and when trees were potted in this soil measles developed. Grafting experiments begun in 1924 have thus far failed to show that the disease can be transmitted in this manner.

Iron sulfate and iron citrate are said to have given temporary relief only as remedies for the chlorosis of plants.

It is stated that about 20 tons of pea seed were treated with hot water prior to planting in 1927, and no mildew appeared in any field planted with diseased seed. Dusting with equal parts of sulfur and hydrated lime controlled pea mildew in the field, only one application being necessary if made before the mildew appeared.

The beet water mold and several related root parasites, C. Drechsler (*Jour. Agr. Research* [*U. S.*], *38* (*1929*), *No. 6*, *pp. 309–361*, *figs. 17*).—An account is given of studies on the morphology, reproduction, taxonomy, and pathogenicity of *Aphanomyces cochlioides*; *A. cladogamus*, which attacks sugar beets;

A. camptostylus which was isolated from oat roots; *A. raphani*, which is parasitic on radish; and *Plectospira gemmifera*, which was islolated from sugarcane rootlets.

Technical descriptions are given of the different organisms, and *A. cladogamus*, *A. camptostylus*, and *P. gemmifera* are described as new species.

Color mutations in Puccinia graminis tritici (Pers.) Erikss. and Henn., M. NEWTON and T. JOHNSON (*Phytopathology, 17 (1927), No. 10, pp. 711–725, pl. 1, figs. 4*).—An account is given of the appearance and study of two color mutations, one bright orange and the other grayish-brown, in the uredinial stage of *P. graminis tritici*. The aecial and telial stages have not yet been studied. No perceptible difference in infection capability developed with the mutation so far as the 12 standard differential host varieties are concerned. Both mutants differ markedly from the normal in urediniospore viability, which drops from the normal, 86.32 per cent, to 61.24 per cent for the orange mutant, and to 53.16 per cent for the grayish-brown mutant. The urediniospores of the mutants are markedly shortened, but are still binucleate. Colors are altered slightly also in the mutation. A chemical study evidenced carotin in the spores both of the normal and of the orange mutants, but not in those of the grayish-brown mutant.

The enzymes of Pythiacystis citrophthora Sm. and Sm., L. J. KLOTZ (*Phytopathology, 17 (1927), No. 10, p. 747*).—In a survey of the enzymes of the mycelium of *P. citrophthora*, positive evidence was obtained for some of the lower esterases, for diastase, invertase, maltase, emulsin, phlorhizinase, asparaginase, urease, peroxidase, and catalase; less evidence for cytase, lactase, and hesperidinase; slight for inulase, pectinase, protease, and glycolase; and none for other enzymes sought. The need is emphasized for check determinations on both the active and deactivated enzyme material, and a more accurate method of calculation is given. The diastase of *P. citrophthora* attacks vigorously gelatinized starch but feebly starch suspended in cold water. Though urea solution of the strength tried could not be used by the fungus, the enzyme powder gave a strong urease reaction.

The thread blight disease caused by Corticium koleroga (Cooke) Höhn. on citrus and pomaceous plants, F. A. WOLF and W. J. BACH (*Phytopathology, 17 (1927), No. 10, pp. 689–709, pl. 1, figs. 10*).—A thread blight disorder of *Citrus grandis* and of *C. sinensis*, known locally as the shoe string disease, first recorded for the United States as on Citrus in 1920 when observed near Okeechobee, Fla., and as on apple in 1907, was studied and tentatively identified as *Corticium stevensii*. It was positively identified in 1926 as *C. koleroga*, the identity of which with *C. stevensii* is considered as established by these studies as here outlined.

The disease, as it appears on leaves, twigs, and fruits, is characterized on apples by the presence of brown clinging rhizomorphs and sclerotia on fruits and twigs. On Citrus the symptoms are the same, except that sclerotia are less abundant.

The thread blight fungus has been isolated in apparently identical form out of basidiospores cultured from grapefruit, pear, pecan, and tung oil, and its pathogenicity has been proved by repeated inoculations from pear and grapefruit.

Hibernation occurs by means of sclerotia. The disease is locally spread through basidiospores. Infection occurs by penetration of the stomata. The mycelium is intercellular in grapefruit, pear, pecan, and pomegranate. High humidities and temperatures are necessary for its spread and development.

The thread blight disease in Florida has been controlled by a single application at the onset of the rainy season of 3-3-50 Bordeaux mixture with 1 per cent of oil as an emulsifier.

Yellows disease of celery, lettuce, and other plants transmitted by Cicadula sexnotata (Fall.), H. H. P. SEVERIN (*Hilgardia [California Sta.], 3 (1929), No. 18, pp. 543-582, pls. 6, figs. 15*).—Celery and aster yellows are reported to have been first noticed in California in 1925, since which time the disease has spread over a considerable area in the State. Studies were made of this disease and similar ones on other plants, with special reference to their identity and means of transmission.

The author presents data to show the identity of the yellows of celery, aster, and lettuce, and that the six-spotted leafhopper (*C. sexnotata*) is capable of transmitting the disease.

Dehulling barley seed with sulfuric acid to induce infection with covered smut (Ustilago hordei), F. N. BRIGGS (*Phytopathology, 17 (1927), No. 10, pp. 747, 748*).—During experimentation at Berkeley, in cooperation between the California Experiment Station and the Bureau of Plant Industry, U. S. D. A., barley seeds dehulled with sulfuric acid (2 or 3 times their volume), then well washed, and inoculated with covered smut (*U. hordei*), gave the same order of percentages of smut infection as hand-dehulled seeds gave on inoculation. The percentages of plant production and of smut inoculation are also tabulated for Tennessee Winter barley grown from seed treated for periods of from 5 minutes to 24 hours with concentrations ranging from 30 to 90 per cent of sulfuric acid and then seeded in the fall of 1926 at Davis, Calif.

A study of growth habit and rust reaction in crosses between Marquis, Kota, and Kanred wheats, O. S. AAMODT (*Phytopathology, 17 (1927), No. 9, pp. 573-609, figs. 2*).—On the basis of data presented in this paper as obtained in cooperative investigations in the Office of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. D. A., and the University of Minnesota, the author states that Kanred winter wheat sown in the greenhouse in the fall shows a continuous growth curve similar to that of spring wheats, with no indication of a period of dormancy, and that freezing temperatures are not essential to culm and flower formation. Kanred sown in the greenhouse in the late winter or early spring will remain dormant for several months and not show a continuous growth curve as do the spring wheats, freezing temperatures being requisite to the heading of this wheat.

In the F_2 of the cross between Marquis and Kanred there appeared 4,811 spring types to 442 winter types, and between Kota and Kanred 1,177 spring types to 128 winter types. In the F_3 the ratio approximated 7 lines homozygous for spring habit to 8 heterozygous for spring and winter habit in material in which the winter types had been eliminated in the F_2. In the F_3, from a random F_2, the ratio approximated 7 pure spring to 8 heterozygous to 1 pure winter. Approximately one half of the heterozygous lines segregated into 15:1 ratios for spring and winter types and the other half into 3:1 ratios. It is supposed that Marquis and Kota contain each 2 pairs of dominant factors for spring habit, and that Kanred contains the recessive allelomorphs for winter habit.

Several factors are concerned with early and late heading in addition to the 2 factors for growth habit. Earliness was dominant to lateness. The segregation in the F_2 and F_3 was too complex to permit a detailed genetic analysis of the factors concerned, and further studies are considered necessary. In a back cross of a late spring hybrid selection from Marquis × Kanred to Marquis no winter forms typifying Kanred in the segregating generations appeared, and

the segregation for early and late heading suggested at least a 2-factor difference with earliness dominant to lateness.

Immunity in Kanred from several physiologic forms of stem rust in crosses between Marquis and Kanred is governed by a single genetic factor. In crosses between Marquis × Kanred and Kota × Kanred immunity is dominant to susceptibility to physiologic form 1. The factors for susceptibility to physiologic form 1 in Marquis and for moderate resistance in Kota are both allelomorphic to the factor for immunity in Kanred. A study of F_3 plants of Marquis × Kota indicated that factors for the reactions of these 2 varieties to form 1 are also allelomorphic to each other. It was concluded that there is a multiple allelomorphic series of 3 factors which governs the reaction of Marquis, Kota, and Kanred, to physiologic form 1. No consistent correlations were found between the reaction to form 1 and the structural differences of the parents or the hybrids. The differences in reaction to this form of rust, to which Marquis is susceptible and Kota is moderately resistant, appear to be due to physiologic causes.

Studies on the control of millet smut, L. E. Melchers (*Phytopathology, 17 (1927), No. 10, pp. 739–741*).—Smut (*Ustilago crameri*), the most important disease attacking millet in Kansas, was studied extensively at the Kansas Experiment Station during 1925 and 1926. Some of the more promising fungicides were tested, both in liquid and in dust form, two sowings being tried in 1925 and one in 1926. The artificially applied smut load was much greater than would ordinarily occur on millet seed, as it was desired to ascertain the limits of efficiency of the fungicides severally. The untreated checks became severely infected.

As a result of the two years' tests, it is stated that the most effective wet treatments included formaldehyde, copper sulfate, and Uspulun. Formaldehyde should not be used as it seriously impairs germination. Copper carbonate is the most effective and economical dust. At least 4 oz. of this per bushel of seed are required for the best results. Such applications as the various sulfur dusts, Bayer dust, and colloidal copper dust do not give satisfactory control.

A cytological study of Puccinia coronata Cda. on Banner and Cowra 35 oats, M. L. Ruttle and W. P. Fraser (*Phytopathology, 17 (1927), No. 10, p. 748*).—In a cytological study of the development of uredinia and telia of crown rust (*P. coronata*) on Banner oats (susceptible) and Cowra 35 oats (variable in resistance), it was found that the formation of appressoria and entry take place in the same way on both hosts. Particulars are given. Haustoria on Cowra 35 grow to 18μ, may function briefly, and are frequently killed. In Banner, the host tissues show evidence of stimulation and increased turgor. The nuclei move over to the haustoria, increase in size, then contract, and die. On Cowra 35, attacked cells often collapse and die, adjoining cells showing increased turgor, impoverishment, and nuclear enlargement. Numerous yellowish-brown, rounded intracellular bodies of dimensions from 3 to 18μ are found in old infections and uninfected tissues dying of old age. Paraphyses are sometimes found at the margin of the uredinium.

The relation of insects and weather to the development of heart rot of celery, J. G. Leach (*Phytopathology, 17 (1927), No. 9, pp. 663–667, figs. 2*).—A celery heart rot, supposedly identical with that described by Wormald and by him considered due to the organism which he described as the new species *Bacillus apiovorus* (E. S. R., 34, p. 244), but which he later conceded to resemble greatly *B. carotovorus* (E. S. R., 37, p. 751), is, in the present article, reported on as the result of observations and investigations lasting over four years. The agency of *B. carotorus* (which is especially susceptible to desiccation and gener-

ally most destructive under conditions of high humidity) in this connection is rendered inexplicable by the fact that destructive heart rot outbreaks occur only in hot, dry weather and are usually worse on the drier bogs.

Investigations started in 1923 are outlined which are claimed to show that *Scaptomyza graminum* and *Elachiptera costata* are common agents of inoculation of celery heart rot, with other insects as possibly equally effective in spreading this disease. During 1926, attempts at testing the control of this disease by dusting with insecticides were without results, due to prolonged rainy weather and the nondevelopment of the disease even on the rows that were not dusted.

Notes on the Cercosporella leafspot of Chinese cabbage in Massachusetts, W. H. DAVIS (*Phytopathology, 17 (1927), No. 9, pp. 669, 670, pl. 1*).—This leaf spot of Chinese cabbage is said to have been first observed in September, 1925, and to have been collected from outdoor plats during each week until they were covered with snow in the succeeding January. In the fall of 1926 the disease reappeared, but was less prevalent and injurious. It was generally severe during the cool autumn weather, but not severe during the main growing and harvesting season. The symptoms are described, as are the features of the associated organism, also inoculations and results. The organism causing this disease of Chinese cabbage is at least provisionally considered to be *Cercosporella albo-maculans*. Synonymous with this are *Cercospora blowami*, *Cercospora albo-maculans*, and *Cercosporella brassicae*.

A bacterial leaf spot of horse-radish caused by Bacterium campestre var. armoraciae, n. var., L. MCCULLOCH (*Jour. Agr. Research [U. S.], 38 (1929), No. 5, pp. 269–287, pls. 2*).—A description is given of a disease of horseradish caused by *B. campestre armoraciae*, which is known to be present in Virginia, the District of Columbia, Connecticut, Missouri, and Iowa. The causal organism has been isolated and its pathogenicity established. The morphological and cultural characters of the organism are described at length, and the results of infection experiments on other host plants are given. A comparison is made between this variety and *B. campestre* and *B. phaseoli*, both of which it resembles in some of its characters.

A technical description is given of the new variety.

Bacterial blight of pea: Overwintering, dissemination, and pathological histology, V. SKORIC (*Phytopathology, 17 (1927), No. 9, pp. 611–627, pls. 3, figs. 8*).—Attempting to find whether the pea-blight organism is seed borne, how it spreads, what other legumes are susceptible, and what occurs in the plants attacked, the author claims to have shown that the organism used in this work was *Pseudomonas pisi*, and that it attacks *Vigna* sp., *Pisum sativum*, *Dolichos lablab*, *Lathyrus odoratus*, *L. latifolius*, and probably other species of Lathyrus. Infection often occurs on the sepals, spreading to the peduncle and pods. Seeds in badly infected pods show bacterial films, with sometimes a water-soaked spot near the hilum. During moist weather, bacterial masses exude in the form of short cirri, which, absorbing water, become bacterial slime.

A dry bacterial film on the seed and inside the seed coat overwinters the organism, which remains viable and capable of spreading the blight for at least 10 months. The organism penetrates through wounds, but also through stomata on leaves and sepals. It spreads intercellularly and intracellularly, breaking down cell walls by pressure and by chemical action and producing large cavities under favorable conditions. The important effect is shown in the invasion of the vascular bundles, with consequent wilting of leaflets or even of the whole plant. Pods are attacked largely through injuries. The organism enters the seed through the funiculus and passes via the micropyle into the seed coat, where it remains alive but dormant.

Investigations on the leaf-roll and mosaic diseases of the potato, P. A. MURPHY and R. MCKAY (*[Irish Free State] Dept. Lands and Agr. Jour., 26 (1927), No. 4, pp. 295–305, pls. 4*).—This report continues the investigations previously noted (E. S. R., 61, p. 47), dealing with results of immediate practical interest.

The complicating effects of frost and hail injury on foliage development in relation to those diseases are indicated. The sprout-index method, as here used, failed to distinguish with certainty between diseased and healthy plants of the same lot, or among lots containing widely different amounts of serious disease. Similar negative conclusions were drawn from a consideration of the situation of the shoots, medium to apical dominance showing in 90 per cent of the tubers, whether healthy or diseased with leaf roll or mosaic. In two-thirds of the cases in which the development was not apical, it became clear that a pathological factor was present, the pathogene being *Corticium solani*, which girdled the sprouts.

All the varieties showed about equal susceptibility to leaf roll. The conclusion reached from tabulated results is that, after infection, varieties react to leaf roll in the same manner, if not to the same extent, as in the case of mosaic diseases. No carriers of leaf roll are known, but some varieties retain much better than others their vigor after infection. The effects of the disease are not cumulative, year after year, unless other infection is contracted.

In the case of primary leaf roll occurring early in the season, considerable yield reduction may result. The reaction to leaf roll is related to the variety rather than to the place of growing.

Convincing proof regarding the effects of using immature seed tubers was obtained at Glasnevin in 1926. Immature seed possesses no inherent advantage (as has often been claimed), and is in fact distinctly inferior to mature seed, except where infection with a serious virus disease is prevalent. The mature seed is then likely to contract a greater amount of disease owing to the longer period during which it is exposed to infection.

As regards the spread of leaf roll in the field, it is stated that approximately 87 per cent of all the infections that occurred was confined to the first drill (beside the leaf-roll drill plants), 9 per cent to the second drill, and 3 per cent to the third drill.

Tobacco mosaic on potatoes, F. M. BLODGETT (*Phytopathology, 17 (1927), No. 10, pp. 727–734*).—In the study here outlined of tobacco mosaic on potatoes, the author obtained results said to agree with those of Johnson (E. S. R., 52, p. 350) and also with those of Fernow (E. S. R., 54, p. 842), the seeming difference in the reports cited arising allegedly from the fact that the former used Bliss Triumph potatoes for inoculations with tobacco mosaic, while the latter used the Green Mountain variety.

The present author found tobacco mosaic to produce different symptoms on different potato varieties. These are described. Preliminary experiments on other potato varieties indicate that potato mosaic produces a wide range of symptoms. Marked mosaic symptoms were obtained only at relatively high temperatures, about 26° C. (78.8° F.) and upward, no symptoms appearing at temperatures from 15° to 18°.

The needle puncture method, if numerous punctures are employed, is effective for inoculating tobacco virus into potatoes. Tobacco mosaic virus is readily transmitted from potatoes back to tobacco, although this brings out not the tobacco mosaic disease alone, but a combination of tobacco mosaic and the virus disease commonly carried by apparently healthy commercial potatoes.

Ecological studies of curly-top of sugar beets, W. CARTER (*Phytopathology, 17 (1927), No. 10, p. 747*).—High intensity in light, temperature, and evaporation appear to favor the development of severe curly top symptoms, also to affect the number of positive cases. In experiments on the control of the external environment, using various pigments, significant differences were obtained in the yield of beets sprayed with pigments.

Curly top symptoms on the sugar beet, H. H. P. SEVERIN (*California Sta. Bul. 465 (1929), pp. 35, pls. 4, figs. 13*).—Popular descriptions are given of the symptoms of curly top of sugar beets and their resemblance to other beet diseases and insect injuries. The practical value of recognizing the disease by sugar factory and field men is shown, and suggestions are given as to the proper irrigation to be adopted and crop rotation for reducing losses.

Additional host plants of curly top, H. H. P. SEVERIN (*Hilgardia [California Sta.], 3 (1929), No. 20, pp. 595–636, pls. 4, figs. 25*).—In a previous publication the author gave a list of species and varieties of plants in the families Chenopodiaceae, Leguminosae, Cucurbitaceae, Solanaceae, Cruciferae, and Umbelliferae that were found to be naturally infected with curly top in California (E. S. R., 58, p. 342). In the present publication the list is considerably extended, and a large number of species and varieties of economic plants representing the above families and others are reported as having been infected experimentally. A considerable number of species are added to the previous list, and, in addition, a number of species and varieties representing the Polygonaceae, Malvaceae, Linaceae, Boraginaceae, and Valerianaceae were experimentally infected. Curly top is now known to be capable of infecting plants included in at least 11 families.

Possible etiological rôle of Plasmodiophora tabaci in tobacco mosaic, G. K. K. LINK, P. M. JONES, and W. H. TALIAFERRO (*Bot. Gaz., 82 (1926), No. 4, pp. 403–414*).—In a joint contribution from the department of botany and that of hygiene and bacteriology of the University of Chicago, the authors report the results of studies undertaken to ascertain whether there exists a constant association between tobacco mosaic and the organism discovered by Jones and by him named *P. tabaci* (E. S. R., 57, p. 846), and whether this organism actually plays a part in the etiology of this disease. Mention is made also of the preliminary work of Eckerson (E. S. R., 57, p. 351). Tissues from healthy and from diseased tobacco plants were cultured, seeking a correlation between the mycetozoan and mosaic. Healthy tobacco plants were inoculated with cultures of *P. tabaci* from healthy and diseased tissues to ascertain whether such cultures carried the virus of tobacco mosaic. Juice of diseased plants was filtered through diatomaceous and porcelain filters. The filtrate was then cultured and afterwards inoculated into young tobacco plants to ascertain whether *P. tabaci* can be cultured from known infective filtrates. Cultures of *P. tabaci* were similarly filtered and the filtrates cultured to test the filterability of the mycetozoan. The infectivity of such filtrates was also tested by suitable inoculations. The work and its results are detailed.

It is stated that *P. tabaci* can be cultivated both from healthy plants and from those affected with mosaic, provided they are not washed in an antiseptic solution. If they are washed in mercuric chloride, *P. tabaci* can frequently be obtained from diseased but only rarely from healthy plants. Inoculation of tobacco plants with cultures containing various stages of *P. tabaci* is followed by mosaic only when the cultures are derived from diseased plants, in which case a concomitant mosaic virus could be present and carried by dilution. Cultures prepared from diseased leaves are sometimes negative for *P. tabaci* and still efficacious in the production of mosaic. Filtrates from diseased plants

are infective, but do not show *P. tabaci* after standing for various lengths of time. Furthermore, such filtrates are suitable culture media for *P. tabaci*, as was demonstrated at the end of each experiment. *P. tabaci* in the plasmodial stage does not pass the filters.

Effect of mosaic disease on yield and quality of tobacco, J. E. McMurtrey, Jr. (*Jour. Agr. Research [U. S.], 38 (1929), No. 5, pp. 257–267, figs. 6*).—A report is given of studies begun in 1925 and continued through 1927 on the effect of mosaic disease on the yield and quality of tobacco.

Three forms of damage are recognized on the green leaves, namely, ordinary mottling, a form in which the mottling is accompanied by necrotic spotting, and a blister form which occurs on leaves showing no mottling. The cured leaves from plants affected with mosaic disease are said to exhibit dwarfing with some discoloration but not in the distinct patterns seen on the green leaves. The most striking effects of the disease on the cured leaf are said to be the spots, which are of the same types as those occurring on the green leaves. The yield and quality of tobacco were found to be adversely affected by the disease. When inoculation took place at transplanting time the yield was reduced from 30 to 35 per cent and the gross value of the crop per acre more than 55 per cent. When infection took place one month after transplanting the damage was almost as severe as that caused by inoculation at transplanting time. Inoculation at topping time did not produce a significant reduction in yield, but the quality of the crop was lowered by the development of the disease.

Purification of the virus of tomato mosaic, P. H. Brewer, H. R. Kraybill, and M. W. Gardner (*Phytopathology, 17 (1927), No. 10, p. 744*).—The freeing of tomato mosaic virus somewhat completely from plant juice constituents and the separation of this virus in large quantities in the form of a clear and colorless suspension as a preliminary step to the study of the properties of the virus is said to have been accomplished by two different methods, both of which are briefly described.

Inoculation experiments with western yellow tomato blight in relation to environmental conditions, M. Shapovalov (*Phytopathology, 17 (1927), No. 10, p. 746*).—Experimentation proved conclusively that curly top virus introduced into tomato plants by *Eutettix tenella* may under specific environmental conditions cause a condition indistinguishable from tomato western yellow blight. Though it was practically impossible to attain the complex of field symptoms in the greenhouse, particularly with the caged plants, perfect blight specimens were obtained in tomatoes grown outdoors without protection or in light muslin cages.

Shading retards the disease and partly prevents its progress. Though under heavy shading certain field characters of the blight are lacking, the curly top symptoms are rendered more conspicuous. Light and humidity appear to be the most important separate factors in the development of the complete field symptom complex. High temperature may shorten the incubation period, but it can not without the proper heat and moisture cause the blight complex. Such factors as age may strengthen or weaken the plant's resistance to blight.

It is suggested that, for the purposes of brevity, of conforming with the facts, and of including similar diseases of other crops, the name tomato western yellow blight be changed to tomato yellows.

The treatment of lime-induced chlorosis in fruit trees, J. P. Bennett (*Phytopathology, 17 (1927), No. 10, pp. 745, 746*).—Chlorosis of pear trees standing in calcareous soil was remedied, completely in 90 per cent and incompletely (owing, supposedly, to a too small dosage) in 10 per cent of the cases, by the insertion of powdered ferric citrate (0.5 gm. in each dose) in holes 1

cm. in diameter and from 3 to 5 cm. in depth, at intervals of from 8 to 10 cm. around the main root, and closing these openings with grafting wax. The dormant season is preferable for this treatment to avoid leaf injury. The effect lasts for 2 years. The cost ranges from 2 to 10 cts. per tree, according to size, in trees from 3 to 30 years of age. Similarly good results were obtained with chlorotic prune and walnut trees, and like treatments have proved effective when using ferrous tartrate, ferrous sulfate, ferric malate, and other soluble iron salts.

Increasing prevalence of Hypochnus rot of apples, L. F. BUTLER (*Phytopathology, 17 (1927), No. 10, pp. 743, 744*).—A rot supposed to agree in essentials with that described by Eustace as due to *Hypochnus* sp. (E. S. R., 15, p. 375) is said to have been noted recently, mostly on Baldwin apples, at many of the eastern markets. *Cephalothecium roseum* was not found in any instance. Other apple varieties named are said apparently to have shown the presence of *Hypochnus* sp. at widely separated points.

"Target canker" of apples and pears, J. W. ROBERTS (*Phytopathology, 17 (1927), No. 10, pp. 735–738, fig. 1*).—Apple target (concentric) canker is discussed as seen at the Arlington Experiment Farm, in Virginia, in 1922, and as exemplified in specimens sent later from Kentucky, Virginia, and West Virginia. Of commercial varieties, Delicious and Jonathan appear to be the most susceptible. The disease may be nonparasitic. Comparisons are made with other diseases. Of 96 cultures from young cankers, 54 were sterile, 40 showed various fungi (chiefly *Physalospora malorum*, *Coniothyrium* sp., and *Alternaria* sp.), and 2 showed the presence of bacteria. Debility or crown gall in seedlings and unfavorable conditions may have favored the disease. The more rapidly growing trees are relatively free from target canker.

Dwarf of blackberries, S. M. ZELLER (*Phytopathology, 17 (1927), No. 9, pp. 629–648, figs. 12*).—The dwarf disease of the vining blackberry (dewberry), recognized in the Pacific Coast States as early as 1918, occurs everywhere on the variety Phenomenal, infecting also the loganberry and Cory Thornless and Kittatinny blackberries. One full season of dwarf destroys the value of a plant. Plantings of Phenomenals, not rogued, have been rendered valueless within three years. Losses in the loganberry may be slight, or may justify eradication. The disease is described. Transmission experiments show it to be a virus disease. It was carried, in one experiment, in a mixed colony of aphids (*Capitophorus tetrarhodus* and *Macrosiphum dirhodum*) from *Rosa rubiginosa*, and in another by *C. tetrarhodus* alone. Experiments with juice injections, as those with bud grafting, were negative. Environmental changes affected very slightly the symptoms of dwarfed plants. Dwarf symptoms partly agree, but mostly disagree, with those of other virus diseases indicated.

Preventive measures include the use of dwarf-free stock, exclusion of the Phenomenal blackberry where the loganberry is desired, and roguing where the incidence of dwarf does not rise above 5 per cent.

Storage rots of cranberries in the 1926 crop, N. E. STEVENS and H. F. BAIN (*Phytopathology, 17 (1927), No. 9, pp. 649–655, figs. 2*).—In an attempt to measure quantitatively the actual storage rots due to various fungi in Howes and McFarlin cranberries from growing regions in Massachusetts, New Jersey, Wisconsin, and Oregon, the authors found the end rot organism (*Fusicoccum putrefaciens*) to be decidedly the most important storage rot fungus, though several others caused lesser and varying degrees of loss in the different regions. End rot developed increasingly as the season advanced, though all other fungus storage rots either remained about constant or decreased in importance with advance of season.

A progressively increasing percentage (varying with locality of origin) of berries spoiled without evident fungus infection. This fact supposedly gave a clue to the relative inherent strength of the berries (that is, resistance to the onset of senile conditions or to breakdown due to smothering) as grown under the diverse climatic conditions prevailing over the four areas selected.

Relation of temperature to growth of Penicillium italicum and P. digitatum and to citrus fruit decay produced by these fungi, H. S. FAWCETT and W. R. BARGER (*Phytopathology, 17 (1927), No. 10, pp. 746, 747*).—Approximately the same optimal temperature was shown for development, on culture media as well as on orange fruits, by *P. italicum* as by *P. digitatum*, though the difference between the growth at optimum temperature and that at other temperatures was greater in the case of *P. digitatum*. In most cases the decay developmental rate was greater at the stem than at the stylar end of the fruit, as was also the percentage of decay incidence due to (equal) injuries. In the lots of fruit inoculated with *P. italicum* and held at 66.8, 74.8, or 80.6° F., nearly all fruits began to decay in 4 days, while lots held at 86 and 57.5° were in similar condition in 8 days and lots held at 50° in similar condition in 12 days. In the lots inoculated with *P. digitatum*, much the same general relation of temperature to time and percentage of decay was noted, except that the temperatures above and below the optimum seemed to have a greater relative inhibiting effect than in the lots inoculated with *P. italicum*.

Notes on fruit decays of the feijoa (Feijoa sellowiana Berg), W. T. HORNE (*Phytopathology, 17 (1927), No. 10, p. 745*).—From studies carried on principally with fruit from the California Citrus Experiment Station, it is concluded that gray mold (*Botrytis cinerea*) is the most common cause of fruit spoilage of feijoa over the area represented by this work. The decay, which is rather tough, becoming somewhat dry, invades the fruit and soon destroys the characteristic flavors. In cool, dry air the infected fruit merely withers. Apple green mold (*Penicillium expansum*) is next in importance. The blue and the green mold were not fonnd to occur naturally on feijoa, and they developed poorly on inoculation. Anthracnose or withertip fungus (*Colletotrichum gloeosporioides*) was found in one case. *Alternaria* sp. and other molds develop abundantly on overripe fruit.

Behavior of Cladosporium effusum (Wint.) Demaree on some varieties of pecan, J. B. DEMAREE and J. R. COLE (*Jour. Agr. Research [U. S.], 38 (1929), No. 6, pp. 363–370*).—In a previous publication (E. S. R., 52, p. 152) the senior author called attention to the varying susceptibility of varieties of pecan to the fungus *C. effusum* and suggested the possibility of there being different strains of the pathogene. This led to further studies of the organism, and the results of preliminary experiments are held to indicate that there is not only physiologic specialization of the fungus, but also that there is either a mixture of forms of the pathogene on similar host varieties or a plasticity in the adaptability of forms.

Sand burn of pecan seedlings, J. B. DEMAREE (*Phytopathology, 17 (1927), No. 9, pp. 657–661, pl. 1*).—Sand burn of pecan seedlings, observed by the author near Cairo, Ga., in the summer of 1922, but supposed to have been present in southern pecan nurseries for several years previously, is reported, allegedly for the first time. It is described with an account of its supposedly significant factors, economic importance, heat injury to other plants, and preventive measures, including the planting of high grade seed in the early winter, the avoidance of deep sandy soils (as subject to overheating), and the selection of a nursery site not having a westerly exposure.

Seedlings in pecan nurseries develop sand burn during the first year. Of the two types, the more striking shows a girdling of the stems at a point near

the soil, resulting in the death of the seedlings, though the blackened leaves do not at once fall. The second less conspicuous but more injurious type results in the death of the young seedlings as they reach the hot surface layer of the soil. Though excessively high soil surface temperature is believed to be the direct cause of pecan seedling sand burn, inferior seed and late planting are considered as contributory.

Preliminary report on the gardenia bud drop, A. WILSON (*Phytopathology, 17 (1927), No. 9, pp. 671, 672*).—In the San Francisco Bay region, gardenia bud drop, or the falling of buds shortly before flowering time, is said to have caused alarming losses in 1925. The disease is briefly described. Tests isolated bacterial colonies, rapidly enlarging, especially at the higher temperatures. Pure culture inoculations from these gave positive results from stems and leaves only when high temperatures prevailed. Careful observation showed that the disease was spread by ants and mealybugs, both of which are said to feed at the extrafloral nectaries. The organism is stated to belong to the bacterial genus Erwinia.

ECONOMIC ZOOLOGY—ENTOMOLOGY

The experimental method as applied to entomological investigations, W. B. HERMS (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 45–59*).—The author regards the experimental method as "'the most important tool of research that scientists employ,' hence it is important that this method of investigation should be employed to best advantage by workers in the field of entomology. To illustrate the use of this method experiments are cited in insect nutrition, hydrogen-ion concentration, medical entomology, plant diseases, insecticides, and light reactions. The use of high grade instruments for observing, recording, and regulating temperature, moisture, air movements, evaporation, humidity, etc., is strongly urged, and a brief account is given of what the author believes to be the necessary qualifications of a worker in the field of experimental entomology."

Application of one of Pearson's probability theorems and some special probability equations to entomological data, F. Z. HARTZELL (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 202–209*).—In this contribution from the New York State Experiment Station the author reports having found that entomological data that are dichotomously divisible can be analyzed by probability methods which seem preferable, in some cases at least, to the usual procedure. Pearson has furnished a system that is considered well adapted to such an analysis. The method of determining the probable error of a percentage is included for use with certain data.

[Economic insects and control measures] (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 268–271*).—The notes here presented are as follows: Persimmon as a Host of the Oriental Fruit Moth, by S. C. Chandler (p. 268); The Purity of Commercial Orthodichlorobenzene, by J. W. Lipp (p. 268); ***Marasmia trapezalis*** Guenée on Sugar-cane only in Hispaniola and Peru of the Western Hemisphere, by G. N. Wolcott (pp. 268, 269); ***Heleria rubidella*** Ball: Comparatively Unknown Membracid Becomes Abundant and Probably Injurious in Orchards in the Wenatchee, Wash., District, by M. A. Yothers, R. L. Webster, and A. Spuler (p. 269); A New Pest of English Walnuts in California, by A. M. Boyce (pp. 269, 270); Note on the Occurrence of the Dusky-veined Walnut Aphis, Callipterus juglandis Frisch (an European Insect) in America, by B. G. Thompson (p. 270); Collecting Vial for Small Insects, by R. Matheson (pp. 270, 271); and ***Cryptolaemus montrouzieri*** Mulsant and Its Allies, by T. D. A. Cockerell (p. 271).

[Work with economic insects in New Mexico] (*New Mexico Sta. Rpt. 1928, pp. 19, 20, 21, 22, 40*).—In work with the codling moth 500 parasites (*Ascogaster carpocapsae*) received from the U. S. D. A. Bureau of Entomology laboratory at Yakima, Wash., were liberated in the college orchards during the egg-laying periods of the first and second generations of the codling moth. Since severe frosts occurred during the time of the first introduction, resulting in a greatly reduced apple crop, it is considered doubtful if the parasite became established. In experiments with baits placed in pails in selected trees in the orchard, table molasses diluted with eight parts of water and apple juice made of fresh chopped apples allowed to ferment without the addition of yeast gave the largest and most consistent catches of moths. Fully fermented fruit juices, such as vinegar, did not prove to be as effective as those placed in the field in a partially fermented or unfermented state, and with mixtures of water and sugar the most attractive period occurred during the early stages of fermentation.

In control work with the San Jose scale a 4 per cent lubricating oil emulsion was tested on a heavily infested peach and apple orchard in the Mesilla Valley. The standard cold-mix formula, consisting of lubricating oil 4 gal., Kayso 4 oz., and water 100 gal., was applied the last week in February. Mortality counts made on March 15 and again early in April showed but two living insects out of 1,000 counted on twigs selected at random.

In apple orchard spraying experiments in continuation of work begun in 1926 (E. S. R., 59, p. 249), a 15-year-old orchard was sprayed, commencing April 3, and counts and observations were made in a manner similar to those recorded on the peach orchard. Only 34.9 per cent of the scales were found to be living, due, it was thought, to partial control obtained the preceding year. A number of mortality counts made in May failed to show any living scale, and the percentage of freshly killed individuals varied between 30 and 35, confirming the counts made before spraying.

In combating the cabbage aphid homemade dusts, using at least 10 lbs. of pulverized quicklime and 6.5 lbs. of nicotine sulfate per 100 lbs. of hydrated lime, were more effective than dusts prepared without the use of quicklime.

Brief reference is made to work with the giant apple root borer, a report upon which has been noted (E. S. R., 60, p. 64).

In work with the beet leafhopper, pyrethrum soap emulsion, Derrisol, and Volck oil (4 per cent) were found very effective in killing the nymphs, the plats receiving these sprays remaining free from young hoppers for the remainder of the season. The materials were not effective, however, in killing the adults, and most of the plants were so severely infected with curly top by this stage of the insect that no benefit could be attributed to the spraying. Observations on the seasonal history indicated that the adults first appeared in fields of seed beets in the Mesilla Valley about May 25. Two complete generations and a partial third were observed in beet fields in the Valley in 1928. A search for wild host plants indicated that the Russian thistle, saltbushes, pigweed, and purslane are plants on which the beet leafhopper is most liable to be found in New Mexico.

Insect enemies of cotton and sugarcane in Peru [trans. title], C. H. T. Townsend (*Estac. Expt. Agr. Soc. Nac. Agr., Lima, Bol. 1 (1928), pp. 29, pls. 21; abs. in Rev. Appl. Ent., 17 (1929), Ser. A, No. 2, p. 100*).—Brief accounts are given of 51 of the more important cotton and 12 sugarcane pests occurring in Peru.

A revised annotated list of the Dermaptera and Orthoptera of New Jersey, H. Fox (*N. J. Dept. Agr. Circ. 138 (1928), pp. 58*).—The various species

and races of Dermaptera and Orthoptera known to occur in New Jersey are recorded, with data on their distribution and seasonal history.

Cotton pests of southern British Togoland and Trans-Volta district, G. S. Cotterell (*Gold Coast Dept. Agr. Bul. 12 (1928), pp. 42, pls. 9*).—Following an introductory account in part 1, which includes a discussion accompanied by a map showing the potential cotton areas where development may take place, part 2 deals briefly with the life histories and habits of the major pests of cotton, illustrations of which are presented in colors; part 3 with the assessment of damage caused by stainers and bollworms; and part 4 with the incidence of stainers on cotton and other Malvaceae. The experimental work outlined was carried out at (1) Abor, in the Trans-Volta district of the Colony; (2) at Kpedsu, representing the southern plains of British Togoland; and (3) at Ve, representing the cotton-growing areas north of the Togoland range.

First report on tobacco insects in Palestine [trans. title], F. S. Bodenheimer (*Zion. Exec., Agr. Expt. Sta. and Colon. Dept. Ent. Circ. 11 (1926), pp. 44, figs. 9; Eng. abs., pp. 42–39*).—This is an account of the more important tobacco insects met with in Palestine, where large areas are being covered by the new culture of tobacco. New insects from wild and cultivated plants, especially those of the Solanaceae, are said to be attacking tobacco.

Preliminary report on attrahents for peach insects, O. I. Snapp and H. S. Swingle (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 98–101*).—The authors report upon the slight attractiveness to peach insects under ordinary orchard conditions of a number of chemicals, as determined by the U. S. Peach Insect Laboratory at Fort Valley, Ga. No attrahents were found for injurious peach insects which showed much promise of being of value from the standpoint of control.

[Insect enemies of yerba maté], E. E. Blanchard (*Min. Agr. [Argentina], Secc. Propaganda e Informes [Circ.] 735 (1928), pp. 17–40, pls. 2*).—This is a practical summary of information of the more important pests of yerba maté in Argentina, several of which are illustrated in colors.

Regulation of Narcissus bulb pests in California, E. L. Smith (*Calif. Dept. Agr. Mo. Bul., 17 (1928), No. 11, pp. 614–619, figs. 3*).—A brief report upon control work with the enemies of Narcissus bulbs.

Toxicity of lead salts to insects, F. J. Brinley (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 221–225*).—The author finds that lead oxide (PbO), lead carbonate, lead sulfate, and lead chromate are slow acting toxic compounds for tent caterpillars. "The order of toxicity is as follows: Chromate>sulfate>carbonate>oxide. There appears to be a direct relationship between toxicity and the molecular weight; an increase in molecular weight increases toxicity. The amount of lead in the body of the insect at the time of death, exclusive of digestive tract, per milligram of body weight, remains constant regardless of the amount of lead oxide eaten."

Insecticidal tests with oils and alkaloids of larkspur (Delphinium consolida) and stavesacre (Delphinium staphisagria), W. M. Davidson (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 226–234*).—"Tests with oils and alkaloids of *D. consolida* and *D. staphisagria* demonstrated that the seeds of these plants have insecticidal properties. The oils in the form of soap emulsions were highly toxic to red spiders and aphids. The alkaloids from *D. consolida* were highly toxic to aphids and thrips, ineffective against red spiders, and of value as stomach poisons against certain leaf feeders. The alkaloid from *D. staphisagria* was much less toxic. The insecticidal value of these products was found to be weakened from the fact that the margin of safety on plant tissues was small. In the case of red spiders, at least, this margin is apparently sufficient."

Further results with fish oil as an adhesive, H. L. Dozier (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 140–146, pls. 2*).—This is a contribution from the

Delaware Experiment Station in which further results obtained from the use of pure Menhaden fish oil as a sticker for lead arsenate with various spray combinations are reported upon (E. S. R., 59, p. 61). It is stated that over 1,000 acres of fruit in the State were sprayed during the year, using fish oil as a sticker in the early sprays, with excellent results.

Bentonite as a dust carrier for nicotine, L. R. Streeter (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 234, 235*).—The author has found bentonite to have high absorbing powers, and that it should not be used as a carrier of nicotine where volatility is desired. Rapid decomposition of nicotine from bentonite-nicotine sulfate mixtures does not take place as suggested. Nicotine can be recovered from bentonite quantitatively by steam distillation.

The bean thrips on pears, H. C. Lewis (*Calif. Dept. Agr. Mo. Bul., 18 (1929), No. 1, pp. 52–58, figs. 4*).—It is pointed out that the bean thrips (*Heliothrips fasciatus* (Perg.)) has been the cause of considerable damage to pears in the mountain valleys of northern California during the past few seasons. This injury is said to be particularly noticeable in the Berryessa Valley of Napa County and to a somewhat lesser extent in Lake County.

A list of host plants of this thrips presented indicates that the species is practically omnivorous. Its injury is caused both to the foliage and to the fruit of the pear. Both young and adult thrips puncture the leaf tissue, and their attack causes the leaves to dry up and turn brown or black. Frequently they attack the ripening fruit and by their feeding produce a silvery scar dotted with the black excrement. This injury lowers the grade of the fruit to the extent that it can not be used for shipping purposes.

As a control measure, a spray combination of oil and nicotine was used and found fairly effective, and when thoroughly applied resulted in a great saving to growers. Both young and adult thrips, when actually hit by this spray, were killed, but a drenching spray which washed all parts of the tree was necessary. The spray combination found most satisfactory consists of a light neutral white oil emulsion 1 gal., nicotine sulfate 0.5 pint, casein spreader 0.5 lb., hydrated lime 0.5 lb., and water 100 gal. This combination has killed those thrips it has hit and causes no injury to fruit or foliage.

Leaf-hopper immigrants of economic interest, H. Osborn (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 209–213*).—The author calls attention to the fact that the leafhoppers of this country have not been given due consideration, owing to their small size and inconspicuous character. The restriction to introduced plants and the absence of seasonal cycles are suggestive of immigrants from tropical regions. The egg stage is favorable to the introduction of such species. Observations are given on the introduction and distribution of the following: *Idiocerus scurra, I. cognatus, Allygus mixtus, Platymetopius hyalinus, Deltocephalus pulicarius, D. pascuellus, D. ocellaris, D. collinus, D. abdominalis, D. striatus, D. flavicosta, Euscelis obscurinervis, Draeculacephala reticulata*, six-spotted leafhopper, *Balclutha punctata, Empoasca fabae, Eupteryx melissae, Typhlocyba ulmi, T. rosae, Perkinsiella saccharicida*, and *Peregrinus maidis.*

The purpose of predicting outbreaks of Eutettix tenellus (Baker) under present-day conditions, W. Carter (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 154–158*).—The author finds that there are three types of districts for which prediction of outbreaks of the beet leafhopper might be worked out. "Prediction for beet-growing districts located contiguous to breeding grounds is only a palliative, but of proven usefulness. Progress in disease-resistance work encourages industry to hold on in such territories. Prediction is very desirable for districts which receive their infestations as a result of migration from a

distance. Location of centers of dispersal is the first essential step. Probabilities of insects reaching beet fields from these districts complicates the problem. In the third type of district, which also receives infestations as a result of long-distance migrations, the severe damage is very rare. There the problem is principally agronomic, and prediction of outbreaks of *tenellus* is not particularly relevant."

Eutettix tenellus (Baker) as a factor in the production of nicotine for insecticidal purposes, W. CARTER and R. F. CRAWFORD (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 158–160*).—This is a contribution from the U. S. D. A. Bureau of Entomology and the New Mexico Experiment Station, cooperating. The authors found that the beet leafhopper was the cause of a peculiar diseased condition in experimental plantings of tobacco grown as a source of nicotine at Albuquerque, N. Mex., in the summer of 1927. It was observed that a native tobacco, known locally as "poncha," was immune to the disease.

***Isolation of certain yeast forms from* Eutettix tenellus Baker**, W. CARTER and F. B. COTNER (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 237–241, pl. 1*).—"The importance of the internal condition of the insects in connection with insect-borne diseases of plants is stressed, and attention is called to two yeast forms found in culture solutions after the feeding of *E. tenellus* Baker. One of these is here described by F. B. Cotner as *Torula tenellicola* n. sp. The other is *Monilia nigra* Browne. The effect of these two yeasts on the optical rotation of sugars is shown in a table."

Leafhoppers (Homoptera, Cicadellidae) found on the sugar beet in Iowa, R. M. JONES (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 243–245*).—The author lists 13 species of leafhoppers observed on sugar beets in 1928, with notes on their distribution and abundance.

The occurrence of the buffalo treehopper in the south of France, and notes on its biology [trans. title], R. POISSON (*Compt. Rend. Acad. Sci. [Paris], 188 (1929), No. 8, pp. 572, 573*).—The occurrence of this pest in France is noted.

Leafhopper injury to legumes, F. W. POOS (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 146–153, pls. 2, fig. 1*).—A brief preliminary report upon studies conducted in 1928 of the injury to legumes by leafhoppers. Among the 15 species of Homoptera tested in cages on various legumes, only *Empoasca fabae* (Harr.) caused the injury, which was serious on alfalfa, red clover, white clover, nonpubescent soybean, peanut, and sainfoin. The disease-like symptoms were not systemic. *E. fabae* free from the infectious principle has not been found to date. Plants not too badly injured always recovered their natural condition when the insects were removed.

Margarodes vitium Giard, a coccid enemy of the vine in Uruguay [trans. title], A. TRUJILLO PELUFFO (*Rev. Facult. Agron. [Montevideo], No. 1 (1928), pp. 75–83, figs. 6*).—A brief account of an important enemy of the root system of the grape in Uruguay.

Two scale insects, their bionomics and control, G. W. HERRICK (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 198–202*).—This is an account of the pine leaf scale (*Chionaspis pinifoliae* Fitch), which infests various pines in private and park plantings, and the magnolia scale, which infests magnolias. The author has found both susceptible to the effects of certain contact insecticides, particularly oils. There was found to be a considerable interval of time when the young nymphs of the pine leaf scale were unprotected by a waxy scale and when they could be hit with a covering spray, while the nymphs of the magnolia scale were in a vulnerable condition from October to the middle of April. Satisfactory control of these two scales has been obtained by timely applications of oil emulsions.

The unsprayed check tree as an indicator of seasonal codling moth activity, W. S. Regan (*Jour. Econ. Ent.*, *22* (*1929*), *No. 1, pp. 65–71*).—The author found that frequent and regular thinning of check trees in connection with codling moth control tests has the advantage of preventing infestation of adjoining test trees, and in addition gives a fairly accurate record of worm activity throughout the season. Evidence is presented of continuous worm work in moderately to heavily infested districts in the Northwestern States. The results obtained when the calyx spray was omitted suggest the possibility that this spray may not be as important under conditions obtaining in the Northwest as is quite generally supposed.

An operation in practical control of codling moth in a heavily infested district.—Third and final report, T. J. Headlee (*Jour. Econ. Ent.*, *22* (*1929*), *No. 1, pp. 89–97*).—In this paper the author reviews the results of a three-year cooperative effort against the codling moth in a heavily infested district near Glassboro, N. J., earlier accounts of which have been noted (E. S. R., 59, p. 349). This cooperation existed between a group of more than 12 growers, whose properties involved a total of over 1,400 acres of bearing apple, and the New Jersey Experiment Stations. In 1925, which was the year previous to the inception of this effort, the average percentage of fruit free from codling moth at picking time was 47.4. In 1926 the average clean fruit at picking time in a crop of 280,200 bu. was 68.8 per cent, in 1927 in a crop of 378,554 bu. 80.8 per cent, and in 1928 in a crop of 309,499 bu. 81.1 per cent. There were, however, individuals and large producers that reached more than 95 per cent of clean fruit, others that were not so successful. It is thought that the small average increase in clean fruit at picking time in 1928 may be attributed mainly to the fear of arsenical residue.

The work has shown that in a cultivated orchard 91 per cent of the overwintering generation of codling moths comes from the trunk and larger branches in the region covered by rough bark, 9 per cent from the branches and twigs above the rough bark, and nothing from the ground under the tree. It has further shown that the application of proper amounts of miscible pine oil to the rough bark portions of the tree results in destruction of all codling moth larvae wintering therein without apparent injury to the trees.

Some factors that limit artificial control efforts for the oriental peach moth, Laspeyresia molesta Busck, A. Peterson (*Jour. Econ. Ent.*, *22* (*1929*), *No. 1, pp. 108–115*).—It is pointed out that up to the present time no insecticidal control or orchard practice is known which is satisfactory or practical in combating the oriental fruit moth (*L. molesta*). The author summarizes the more important factors that limit and influence the different artificial control measures, and expresses his opinion on the future possibilities of finding an insecticidal control measure based on 10 years' experience with the pest. Ovicides, larvacides, dormant control measures, light traps, attractants (baits), and repellents are discussed.

A field test of the effect of artificial light on the behavior of the codling moth, Carpocapsa pomonella Linn., W. B. Herms (*Jour. Econ. Ent.*, *22* (*1929*), *No. 1, pp. 78–87*).—"Six 500-watt lights were suspended directly over a block of 16 trees consisting of several varieties of apples. The plat was flooded with light each evening for 2.5 to 3 hours from April 26, to June 30, i. e., to the end of the first brood of codling moth. Temperature for the period was recorded, and foot candle meter readings were made to ascertain light intensities. Comparing fruit of the same variety at the end of the test it was found that 21 per cent of the apples on check trees outside the test plat were moth attacked, while only 14.5 per cent of the apples inside the test plat were so

affected. Light of the intensity and quality used indicates a tendency to deter the codling moth in its egg-laying habits."

A laboratory method for determining the attractiveness of bands to codling moth larvae, C. R. CUTRIGHT and J. S. HOUSER (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 62–64, fig. 1*).—In this contribution from the Ohio Experiment Station a laboratory method is described and its advantages are pointed out. Tables showing the type of results are included.

Observations on the oil-nicotine combination for the control of the codling moth and other apple insects in the Pacific Northwest, F. B. HERBERT and M. D. LEONARD (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 72–78*).—Two years of experimental work in the Pacific Northwest is said to indicate that a combination of oil and nicotine may have an important place in the apple spray program. Satisfactory and, in most cases, economical control of codling moth, as well as of the other more important apple insects present, was obtained. The spray residue problem was considerably simplified and the grade of fruit was frequently raised as a result of the use of this spray combination.

Oriental fruit moth invades Illinois, W. P. FLINT and S. C. CHANDLER (*Illinois Sta. Circ. 338 (1929), pp. 7, figs. 4*).—This is a brief practical account of the oriental fruit moth, first found in Illinois early in the winter of 1927–28 in Pulaski County. It apparently has become established in all the principal peach-producing sections of the State, but during the summer of 1928 it caused severe damage to peaches only in the Pulaski County section.

Preliminary tests with possible repellents of the oriental peach moth, J. W. LIPP (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 116–126, pl. 1, fig. 1*).—The author has experimented with several methods for testing repellency in a series of experiments conducted at Riverton, N. J., in 1927. Recording the eggs deposited on sprayed twigs in cages (in the insectary), and recording the number of moths coming to bait pans, with and without evaporation cups containing chemicals (in the orchard), seemed the best methods. In the insectary tests sprays of crude α-naphthylamine and Dippel's oil gave the most satisfactory results. The orchard tests revealed four chemicals, furfural, Dippel's oil, ammonium sulfide, and amyl acetate, which showed at least 50 per cent repellency. An apparatus for use in field studies with repellents is described.

Fourth contribution to a study of baits, with special reference to the oriental fruit moth, S. W. FROST (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 101–108, fig. 1*).—This is a report upon work with the oriental fruit moth (*Laspeyresia molesta*) conducted at the Pennsylvania Experiment Station, in continuation of that previously noted (E. S. R., 59, p. 459), in which emphasis is placed upon the attractiveness of solutions of sirups of different brands and sugar content. Studies of molasses and sodium arsenite baits were continued. A summary is given of the results of weekly collections of oriental fruit moths from 30 different baits. A number of other economic insects were attracted to baits, but none, except possibly fruit flies and Noctuidae, appeared in numbers sufficient to reduce the population. Baited blocks did not show reduction of oriental fruit moth injury.

A digest of additional experiments in the application of paradichlorobenzene in solution against the peach borer, E. H. SIEGLER and L. BROWN (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 217–221*).—Additional experiments (E. S. R., 58, p. 848) with paradichlorobenzene dissolved in high-test gasoline and applied around the bases of the peach trees were conducted in the spring and fall of 1927. Results of the tests appear to indicate that the solution form of treatment, even without preparation of the soil before treatment and without banking with soil following the application, is as effective as the application of

the crystals made in the usual way. The use of varying proportions of the solvent in excess of 50 cc. to 1 oz. of paradichlorobenzene apparently decreases the efficiency of the treatment.

A general summary of the European corn borer situation in the United States at the close of 1928, D. J. CAFFREY (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 167–171*).—This is a review of the situation in 1928.

A study of the abundance of Pyrausta nubilalis Hubn. in corn (Zea mays L.) in southwestern France, H. L. PARKER, W. R. THOMPSON, P. DE RIPPAS, and S. KOZLOVSKY (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 183–195, figs. 7*).—This is a report of a study made in southwestern France during the winter of 1927–28.

Nutrition as a factor in the responses of the European corn borer, J. S. HOUSER and L. L. HUBER (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 171–174*).—In this contribution from the Ohio Experiment Station the authors call attention to the growing recognition of the fact that European corn borer abundance is greatly determined by the growth condition of the host. The various responses of the insect, such as the rate of spread, the rate of accumulation, the seasonal fluctuation in population, and the ultimate saturation point, are influenced by the physicochemical processes of the corn plant.

Some factors determining corn borer damage, L. H. PATCH (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 174–183*).—This is a report of the results of observations and experiments conducted with the European corn borer near Sandusky, Ohio, in the summers of 1927 and 1928.

Studies of Platyedra gossypiella Saunders (pink-bollworm) in the Punjab, Part I, S. SINGH BINDRA (*India Dept. Agr. Mem., Ent. Ser., 10 (1928), No. 6, pp. [5]+167–216, pls. 4*).—This contribution on the pink bollworm deals with its status and distribution, seasonal history during the cotton season in the southeastern Punjab, and the resting stage of long-cycle caterpillars and emergence of long-cycle moths. The distinction between real and apparent damage is referred to. Much of the data is presented in tabular form.

Combating the pink bollworm [trans. title], H. BESSE and T. PAGLIANO (*Dir. Gén. Agr., Com. et Colon. [Tunis], Bul., 32 (1928), No. 132, pp. 34–49, figs. 2*).—This is a report on fumigation of cottonseed for destruction of the pink bollworm. Carbon disulfide at the rate of 400 gm. per cubic meter for a period of from 24 to 48 hours was found to destroy the pink bollworm in the seed. Carbon tetrachloride at the rate of 600 gm. per cubic meter appears to be less effective.

Relation of snow cover to infestation by the grape berry moth (Polychrosis viteana Clemens), F. Z. HARTZELL (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 126–132*).—This is a contribution from the New York State Experiment Station.

"In western New York the survival of the grape berry moth during a normal winter was found to be rather closely related to the amount of snow cover present during the periods when the temperature dropped to near zero Fahrenheit. Snow drifting in vineyards on level or north sloping soil furnishes the most continuous cover for the cocoons, and such areas constitute foci of infestation for the pest except during abnormal winters. Practical immunity is secured either by removing obstructions that cause drifts or by avoiding the planting of vines in such places."

Life history and control of the grape berry moth in Delaware, H. L. DOZIER and H. G. BUTLER (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 132–136*).—This is a report of investigations conducted, reference to which has been noted from another source (E. S. R., 60, p. 750).

It is pointed out that the grape berry moth is the worst enemy of grapes in the State. Life history studies during 1928 show that nearly a full third brood developed in the vicinity of Camden, while only a partial third brood took place at Newark. In the Camden section the earliest moths started to issue on May 28, but careful field observations showed that grape berry moth eggs started general hatching in the field on June 25.

Considering control, emphasis is placed on clean-up of leaf accumulations in old hedge rows and grassy strips between vineyards, the use of a good sticker and spreader, and the timeliness, thoroughness, and manner of application.

Observations of the biology of the Mediterranean flour moth [trans. title], P. VOUKASSOVITCH (*Compt. Rend. Soc. Biol.* [*Paris*], *100* (*1929*), *No. 1*, *pp. 62–67*).—Two contributions on the life history and bionomics of this pest are presented.

[**Soaking seed cane for the destruction of the sugarcane borer**] (*Sugar Bul.*, 6 (*1928*), *No. 24*, *p. 2*).—This is a brief account of the results obtained by T. E. Holloway and W. E. Haley in experiments conducted at the Sugar Cane Insect Laboratory of the U. S. D. A. Bureau of Entomology in Louisiana.

Tying cane with chains into bundles and submerging it in a canal by means of a derrick for a period of 72 hours resulted in freeing the cane of all live borers. Although the cane had been injured by freezing and by borers before planting, it came up to almost a full stand in February. The results indicate, as reported by one plantation manager, that where cane is dipped the amount of seed necessary for a full stand should be reduced by at least one-third.

Syneda alleni Grt., a cutworm destructive to blueberry in Maine, C. R. PHIPPS (*Jour. Econ. Ent.*, *22* (*1929*), *No. 1*, *pp. 137–140*).—In this contribution from the Maine Experiment Station the author points out that under Maine conditions a number of species of climbing cutworms attack the blueberry in the early spring, and that during seasons of unusual abundance they cause severe crop losses by destroying the swelling fruit buds. Unlike the common forms, *S. alleni* appears in the larval stage in midsummer. A severe outbreak of this pest occurred in certain Maine blueberry fields in 1927, this being the first record of the insect as of economic importance. The outbreak reached its height in midsummer just prior to picking time, the leaves, green and ripe berries, and even the bark being eaten. During the following June (1928) moths of the species appeared by the millions in the fields which had been infested by the loopers the previous summer. Eggs were obtained on June 28 and larvae on July 4. Because of their slender appearance, looping movement, diurnal habit, and extreme activity, the larvae resemble the geometers quite closely.

Spraying with arsenate of lead at the rate of 1.5 lbs. in 50 gal. of water gave good control. Fermenting bait composed of sirup, water, yeast, and honey gave an average catch of about 200 moths per pan.

The Hessian fly and the Illinois wheat crop, W. P. FLINT and W. H. LARRIMER (*Ill. Nat. Hist. Survey Bul.*, *17* (*1928*), *Art. 11*, *pp. 363–385*, *figs. 13*).—Following a brief introduction, the authors deal with the life history of the Hessian fly, control measures, and date-of-seeding experiments, particularly the results obtained in seeding experiments at different dates in different counties of the State.

Eupelmus popa Girault, a parasite of the sorghum midge, Contarinia sorghicola Coquillett, L. C. WOODRUFF (*Jour. Econ. Ent.*, *22* (*1929*), *No. 1*, *pp. 160–167*).—This is a report of studies of a parasite of the sorghum midge, first discovered in the United States in 1920 at San Antonio, Tex., where it was found well established. It has now supplanted the other parasites of the

midge and taken first place in importance. The larvae are occasionally both parasitic and phytophagous in habit. They normally complete their development on animal food alone, although they may change to plant food in their later stages. The parasite readily attacks and consumes both the larvae and the pupae of the sorghum midge. It is a primary parasite in this relationship, but may also be a hyperparasite in so far as the internal parasites also are destroyed.

Fumigation with calcium cyanide for the control of the greater and lesser bulb flies, F. R. COLE (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 236, 237*).—This is a brief reference to investigations of the effect of box fumigation with calcium cyanide on the larvae and pupae of bulb flies in storage, in which it was found that a mortality of 100 per cent could be obtained with no apparent injury to the foliage or to the flowering of field-grown and forced stock. It was found that calcium cyanide in the form of a finely ground powder from which the gas slowly evolves at a temperature between 60 and 90° F. is best adapted for this type of fumigation. The recommended dosage for 100 cu. ft. is 12 oz. with an exposure of 4 hours.

Report on the black walnut fly, C. GAMMON (*Calif. Dept. Agr. Mo. Bul., 17 (1928), No. 11, pp. 603–605, figs. 2*).—The black walnut fly (*Rhagoletis juglandis* (Cresson)) is said to have appeared in San Bernardino and Los Angeles Counties and to attack practically every known variety of walnut grown there. The Eureka variety is, however, by far the most preferred. The adults emerged in 1928 throughout the month of August and the first part of September, the first fly having been seen on July 25. The first larvae were observed on August 20, at which time they were about 1 week old. From the oviposition puncture the larvae migrate in all directions, and this is closely followed by the ever attendant decay which first appears shortly after the eggs are deposited. As the larvae mature, the nuts turn black on one side and the larvae are found about the periphery of the decayed mass. In about 16 days after hatching the larvae drop to the ground and promptly burrow to a depth of from 2 to 12 in., where they pupate within two days. It is said that as yet there has been no indication of a second brood.

The application of arsenate of lead at the rate of 4 lbs. to 100 gal. of water in one orchard of 110 trees in Chino resulted in a reduction of about 70 per cent in the infestation.

The Mexican bean beetle and how to control it, C. C. HAMILTON (*New Jersey Stas. Circ. 216 (1929), pp. 16, figs. 10*).—This is a practical summary of information on the Mexican bean beetle, which has recently been found in nine counties throughout the State. It is reported as having done some damage in Cape May County in 1927, and was very abundant in 1928 throughout most sections of that county, in many instances completely destroying the plantings of beans.

Hoplocerambyx spinicornis, an important pest of sal, D. J. ATKINSON (*[Indian] Forest Bul. 70 (1926), pp. 24, pls. 5*).—An account of studies of the sal heartwood borer, *H. spinicornis* Newm., outbreaks of which occurred in both the United and Central Provinces.

A revision of the North American species of buprestid beetles belonging to the genus Agrilus, W. S. FISHER (*U. S. Natl. Mus. Bul. 145 (1928), pp. V+347, pls. 11*).—In this revision of the genus Argrilus 131 forms, including 1 fossil form, are recognized, of which 29 are described as new.

The vegetable weevil for the season 1927–28, H. C. LEWIS (*Calif. Dept. Agr. Mo. Bul., 17 (1928), No. 9, pp. 482–492, figs. 7*).—The vegetable weevil is said to have become firmly established in nine counties in the San Francisco

Bay region, where its seasonal history varies slightly each year due to variable weather conditions.

Bee diseases in California (continued), F. E. TODD (*Calif. Dept. Agr. Mo. Bul., 18 (1929), No. 1, pp. 16-37, figs. 4*).—This is a description of and an account of bee diseases in California, the control work under way, etc. (E. S. R., 59, p. 659).

Parasites of the sugar cane moth borers, D. L. VAN DINE (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 248-268*).—This is a review of the present status of knowledge of sugarcane borer parasites in Cuba and of the available records of those occurring in other countries. The parasites are listed by countries and species, and a bibliography of 73 titles is included.

Breeding cane borer egg parasites at Baton Rouge, W. E. HINDS and H. SPENCER (*Sugar Bul., 6 (1928), No. 10, pp. 1-3*).—An account of work under way at the Louisiana Experiment Stations in breeding *Trichogramma minutum*, a parasite of the sugarcane borer.

The production and distribution of Trichogramma, S. E. FLANDERS (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 245-248*).—This is a report on the methods of production and distribution of *T. minutum* as a parasite of insect pests devised by the author in 1926,[1] in which the eggs of the Angoumois grain moth are utilized. Other work by the author (E. S. R., 59, p. 853) has been noted (E. S. R., 59, p. 461).

Large scale production of the egg parasite Trichogramma minutum Riley, G. WISHART (*Canad. Ent., 61 (1929), No. 4, pp. 73-76, figs. 4*).—This is an account of the method used at the Chatham, Ontario, laboratory in the production of *T. minutum*, which is essentially the same as that devised by Flanders in California (see above).

Argentine parasites for Louisiana cane borers, H. E. BOX (*Sugar Bul., 6 (1928), No. 17, pp. 5, 6*).—A discussion of this subject, in which the possibility of utilizing certain Argentine insect parasites of the sugarcane borer is considered.

[Work with sugarcane borer parasites] (*Sugar Bul., 6 (1928), Nos. 11, pp. 1-3; 13, p. 6; 15, pp. 2-4*).—Brief discussions of the work with parasites of the sugarcane borer by H. E. Box, T. E. Holloway, and W. E. Hinds.

Ants attacking tobacco [trans. title], O. PERRIN (*Rev. Tech. Monop. Tabacs Turquie, 1 (1928), No. 3, pp. 91-93*).—An account is given of *Aphaenogaster barbara* Mayr. (*Messor barbarus* L., *Atta barbara*), the first of three myrmicine ants causing injury on tobacco plantations in Turkey.

Two introduced ants not previously known to occur in the United States, M. R. SMITH (*Jour. Econ. Ent., 22 (1929), No. 1, pp. 241-243*).—In this contribution from the Mississippi Experiment Station the author records the establishment in this country of *Iridomyrmex iniquus* Mayr. and *Wasmannia auropunctata* Forel.

Observations on some entomogenous members of the Entomophthoraceae in artificial culture, W. H. SAWYER, JR. (*Amer. Jour. Bot., 16 (1929), No. 2, pp. 87-121, pls. 4*).—It is pointed out that members of this group have formerly been regarded as obligate parasites, and attempts to cultivate them have hitherto met with little success. However, two species, *Entomophthora sphaerosperma* and *Empusa* sp., have been grown by the author in artificial culture on many different media. *Entomophthora pseudococci*, the only other entomogenous species of this family known to be in culture, has been cultivated upon the same media and compared with *E. sphaerosperma* and *Empusa* sp. A list of 47 references to the literature is included.

[1] Jour. Econ. Ent., 20 (1927), No. 4, p. 644.

ANIMAL PRODUCTION

The American Society of Animal Production: Record of proceedings of annual meeting, Nov. 30–Dec. 2, 1928 (*Amer. Soc. Anim. Prod. Proc. 1928, pp. 233, figs. 12*).—The report of the annual meeting held at Chicago November 30 to December 2, 1928 (E. S. R., 58, p. 864; 60, p. 301).

The following papers were presented: Our Responsibility to the Livestock Industry, by E. W. Sheets (pp. 9–15); Phosphatic Limestone and Other Rock Products as Mineral Supplements, by C. Tolle and L. A. Maynard (pp. 15–21); The Normal Retention of Food Iron during Growth and the Utilization of the Iron of Protein Foods, by R. C. Miller (pp. 21–25); Calcium and Phosphorus Balances of Milking Cows under Varying Conditions, by H. B. Ellenberger and J. A. Newlander (pp. 25–28); Inheritance of Persistency of Lactation, by R. B. Becker and P. C. McGilliard (pp. 29–33); Selection for Natural Resistance to Cholera in Swine, by W. V. Lambert, C. Murray, and P. S. Shearer (pp. 33–37); The Inheritance of Chalk-Face in Merino Sheep, by B. L. Warwick and D. S. Bell (pp. 38, 39); The Relation Between Size of Litter, Weights, and Mortality in the Guinea Pig, by G. Haines (pp. 40–42); The Age and Sex Composition of the Cattle Population of the United States and Its Effect on Rate of Reproduction, by J. H. Noble (pp. 42–47); The Development of the Mammary Gland, by C. W. Turner (pp. 47–51); One Substitute for the Aged Steer to Utilize Bluestem Grass, by C. W. McCampbell (pp. 52–55); Bovine Infectious Abortion: Progress of Control Work, by L. F. Rettger and J. G. McAlpine (pp. 56–59); A Three-Year Study of the Value of Adding Calcium Carbonate to Cattle Fattening Rations Containing Only Non-Legumes, by B. M. Anderson (pp. 59–61); An Intensive System of Grassland Management, by C. H. Parsons (pp. 61–67); Problems with Range Cattle Production, by J. H. Shepperd and M. B. Johnson (pp. 67–71); The Feeding Value of Oat Feed for Dairy Cows, A. W. Lathrop and G. Bohstedt (pp. 72, 73); The Use of Purebred Sires in Producing Cattle for the Market, by W. L. Blizzard (pp. 74–77); Value of Legume Hays for Dairy Heifers, by H. E. Dvorachek (pp. 77–83); Some Aspects of Rickets in Swine, by R. R. Thalman and W. J. Loeffel (pp. 83–89); The Effect of Ultra-Violet Light on Suckling Pigs, by G. Bohstedt, W. M. Insko, jr., and J. M. Fargo (pp. 89, 90); The Effect of Grains, Fiber, Type, and Weight on the Yield of Pork Cuts, by W. L. Robison (pp. 91–95); Swine Reproduction as Affected by Restricted Quarters, by A. G. Hogan, L. E. Casida, and F. F. McKenzie (pp. 95–98); Buckwheat Middlings as a Protein Supplement for Growing and Fattening Swine, by J. H. Longwell (pp. 98–101); Alfalfa Pasture Versus Dry Lot for Growing and Fattening Spring Pigs, by W. E. J. Edwards and G. A. Brown (pp. 101–104); Feeding of Soybeans to Hogs in Definite Proportions and Their Effect upon the Quality of Pork, by F. H. Helmrich (pp. 105, 106); Some Remarks on Experimental Methods in Relation to the Study of Quality and Palatability of Meat, by E. W. Sheets (pp. 107, 108); Grading Cattle and Their Carcasses, by L. B. Burk (pp. 109–111); Color in the Quality and Palatability of Meat Project, by P. E. Howe (pp. 111, 112); Histological Investigations of Meat, by H. N. Baker (pp. 113, 114); Progress Report of the Mechanical Test for Tenderness of Meat, by K. F. Warner (pp. 114–116); Report on the Cooking of Meat, by L. M. Alexander (pp. 117, 118); Judging Cooked Meat, by D. A. Spencer (pp. 119–121); The Showring, the Prize Carcass Contest, and the Butcher's Block as Measures of Quality in Meats, by C. R. Moulton (pp. 122–130); Subject Matter for Animal Husbandry Students, by W. A. Cochel (pp. 131–138); Problems Met in Presenting Animal

Husbandry to Undergraduate Students, by F. S. Hultz (pp. 133–139); Extension Work from the Viewpoint of an Ally, by W. A. Cochel (pp. 139–142); The Fundamental Background of Extension Teaching, by H. W. Hochbaum (pp. 142–146); Local Leaders, by E. T. Robbins (p. 147); Production Contests as an Agency for Developing Extension Projects, by O. O. Waggener (pp. 147–150); State Tours as an Extension Aid, by B. F. Creech (pp. 150, 151); Value of Meetings in Extension, by L. A. Kauffman (pp. 151–153); Agricultural Extension Work in Cooperation with Commercial Agencies, by G. J. Baker (pp. 153–156); The Missouri Plan of Sheep Improvement, by J. W. Burch (pp. 156–161); How Many Animals per Experimental Lot? by J. M. Evvard, C. C. Culbertson, and G. W. Snedecor (pp. 161–176); Fall Versus Winter Fattening of Lambs, by W. H. Peters and P. S. Jordan (pp. 176–179); Methods of Measuring Improvement of Judgment in Wool Diameter and Wool Shrinkage Estimation, by R. H. Burns (pp. 179–182); Relation Between Conformation and Pulling Ability of Draft Horses, by A. O. Rhoad (pp. 182–188); The Physical Basis of Sterility, by W. S. Anderson (pp. 188–191); Some Future Aspects of American Agriculture, by R. W. Dunlap (pp. 192–196); and Review of Effect of Poultry House Ventilation and Temperature on Laying Hens, by A. R. Lee (pp. 196–201).

Note on the growth of young mice suckled by rats, A. S. PARKES (*Ann. Appl. Biol., 16 (1929), No. 1, pp. 171–173*).—The results obtained led to the conclusion that the variation in the growth of the various sizes of litter in the normal mouse is purely a question of differential nutrition, and that under conditions of unlimited nutrition the growth of young mice may proceed to a degree which is both unusual and unhealthy.

Approved formulas for special-purpose mixed feeds (*Texas Sta. Circ. 53 (1929), pp. 11*).—Formulas, as approved by the experiment station, the extension service, and the school of agriculture of the Texas A. and M. College, and directions for their use for mixed poultry feeds, dairy feeds, horse and mule feeds, and protein supplements for swine are presented. These formulas are suitable for mill manufacture.

The digestibility of supplemental feed for range cattle in New Mexico (*New Mexico Sta. Rpt. 1928, pp. 57, 58*).—The data obtained in this study (E. S. R., 57, p. 564) indicate that a small amount of supplemental feed caused a slight decrease in the consumption of wheat straw. However, the animals maintained their body weight even with the reduction in feed consumption. When straw alone was fed 2 steers lost 537.8 and 500.9 gm., respectively, of body protein, but when 1.25 lbs. of cottonseed meal was added they gained an average of 894.4 gm. of body protein. On a maintenance and submaintenance ration of straw the animals gained in live weight but lost protein. This gain in live weight is pointed out as possibly addition to fill. Adding cottonseed meal to the straw ration increased the digestibility of the dry matter, organic matter, total nitrogen, albumin nitrogen, ether extract, crude fiber, and nitrogen free extract of the wheat straw. The cottonseed meal caused an approximate increase of 2.58 per cent in the digestibility of the crude fiber of the straw.

Feeding experiments at Karnal, 1925–26 and 1926–27, F. J. WARTH and F. J. GOSSIP (*India Dept. Agr. Mem., Chem. Ser., 10 (1928), No. 1, pp. 24, figs. 3*).—Feeding tests and digestion trials for two consecutive years with feeds for wintering calves at the Imperial Cattle Breeding Farm, Karnal, India, showed that rice straw was more palatable and produced better growth than wheat straw. Good sorghum hay and rice straw were approximately equal in palatability, digestibility, and nutritive value. The digestion trials indicated that when the protein content of the ration varied there was an

appreciable change in the utilization of the proteins and carbohydrates of the feeds.

When rapid growth was not required, it was found that Indian animals thrive on rations with a wider nutritive ratio than is commonly recommended for their age. However, sufficient protein should be fed to insure a regular consumption of feed, for it was fonnd that serious fluctuations in appetites were indications of lack of protein in the diet.

Sheep production in Alberta, J. E. Bowstead and J. P. Sackville (*Alberta Univ., Col. Agr. Bul. 19 (1928), pp. 81, figs. 30*).—A popular publication dealing with the present status of the sheep industry in Canada and the breeding, feeding, management, and marketing of sheep. A brief synopsis of some of the more common diseases of sheep with their important and characteristic symptoms is also given.

***Sheep feeding.*—XVI, *Fattening western lambs,* 1927,** C. Harper (*Indiana Sta. Bul. 325 (1928), pp. 12, fig. 1*).—Continuing these studies in lamb feeding (E. S. R., 58, p. 267), 4 lots of 25 western lambs each were fed for 70 days to determine the value of feeding clover hay once or twice every fifth day, to compare these methods of feeding hay with full feeding every day, and to compare whole oats and shelled corn for fattening lambs. All lots received cottonseed meal and corn silage in addition to the above feeds.

The lambs fed hay once every fifth day made slightly smaller gains, required less feed per unit of gain, and sold for a higher price than those fed hay twice every fifth day. When hay was fed every day the rate and cost of gain were higher, and the finish attained was no better than in the lots where the hay ration was limited. The feeding of oats increased the consumption of concentrates and reduced the consumption of roughages. The oat-fed lambs made larger gains during the early part of the feeding period, cost more per unit of gain, but attained a more desirable finish than did the corn-fed lambs.

The efficiency of cottonseed meal and representative New Mexico roughages for fattening lambs (*New Mexico Sta. Rpt. 1928, p. 57*).—Continuing this study (E. S. R., 59, p. 260), the highest daily gains were obtained in lots fed either corn, cottonseed meal, and alfalfa or cottonseed meal and alfalfa. The cost of gains was cheapest in lots receiving cottonseed meal and cottonseed hulls, but the shrink in shipping was greater and the finish was poorer in these lots.

A comparison of rams of six breeds for siring market lambs, R. F. Miller (*Natl. Wool Grower, 18 (1928), No. 6, pp. 28–31, figs. 7*).—Rambouillet ewes of uniform type, size, conformation, and fleece qualities were divided into 6 lots of 20 head each at the California Experiment Station in an effort to determine which breed of rams is best suited for siring market lambs. The average weight of the ewes at the start of the experiment was 126.5 lbs. The respective lots of ewes were bred to good type purebred rams of the following breeds: Southdown, Shropshire, Hampshire, Suffolk, Romney, and Rambouillet. The study is planned on a 6-year basis, and each lot of ewes will be bred to each of the 6 breeds of rams during this period. The lambs are dropped in December and January and run on pasture with no grain until marketed. Records are kept of a number of body measurements, of birth weight, and of monthly weights of lambs to the time of marketing.

The first year's results show that in weight at birth the lambs ranked as follows: Suffolk, Hampshire, Romney, Shropshire, Southdown, and Rambouillet. In the Hampshire and Suffolk crosses the percentages of twins were 63.6 and 61.5 and in the Shropshire and Southdown crosses 41.7 and 12.5, respectively. In daily gain from birth to 143 days of age the crosses ranked as follows:

Suffolk, Southdown, Shropshire, Romney, Hampshire, and Rambouillet. The grading of the lambs on hoof showed that the Shropshire and Southdown crosses excelled in the number of choice and good lambs, the Romney stood third, Hampshire and Rambouillet next, and the Suffolk last. In the slaughter tests, the Southdown and Shropshire crosses had the largest number of choice and good carcasses, followed in order by the Romney, Hampshire, Rambouillet, and Suffolk. These slaughter tests were made only with the lambs graded choice and good on the hoof.

A macroscopical analysis of the fleeces of four Romney rams, J. F. Wilson (*Hilgardia [California Sta.], 3 (1929), No. 19, pp. 583–594, figs. 5*).—In an endeavor to discover a method of judging the fleeces of breeding sheep more accurately than is possible by a simple examination, samples of wool were taken from 10 different places on 4 Romney rams at the station. The samples were washed in benzene and measured at the midsection with a micrometer.

The finest wool on 3 of the 4 rams was found on the ear or cheek and on the fourth ram on the scrotum. This finding was contrary to the general belief that the finest wool is found on the shoulder. With 3 of the fleeces the least uniform wool was found on the thigh, while with the fourth fleece the belly, back, and side were relatively nonuniform.

Medullated fibers, considered serious defects, occurred most frequently in samples from the side, thigh, back (at hips), and belly, while samples from the shoulder, neck, ear, cheek, and back (at shoulder) were comparatively free from medullated fibers. The coarser parts of the fleece contained the highest proportion of medullated fibers. Generally speaking, the finer portions of the fleece showed a larger ratio of staple length to fiber length, although there were some exceptions to this.

It is stated that this paper, which deals only with fleeces from 4 individuals, must be considered as a preliminary report, and that the tests must be applied to fleeces from several breeds before a satisfactory method of macroscopical analysis can be produced.

A study of the metabolism of two breeds of pig (with some remarks on a third), T. Deighton (*Jour. Agr. Sci. [England], 19 (1929), No. 1, pp. 140–184, figs. 12*).—Metabolism studies with a Berkshire and a Middle White pig from weaning time to maturity were made by means of calorimeters at the Institute of Animal Nutrition, School of Agriculture, Cambridge, England.

The fasting katabolism followed in general the curves previously obtained with a Large White (E. S. R., 51, p. 671), but the fasting katabolism of the Middle White was below this curve. A positive correlation was found between the fall in body temperature and in metabolism during fast, and a note is made of the possible effect of skin color in this relation. A special temperature correction curve was worked out for the Middle White pig which led to the discovery of its exceedingly low critical temperature. It was concluded that the maximum which exists in the curve showing fasting katabolism per unit area at different ages is due to two physiological facts, "(a) that warm-blooded animals have to be maintained at a temperature which varies only within very narrow limits, and (b) that the processes of growth are accompanied by waste of energy as heat." The fasting katabolism per unit area is shown to be greater in pigs than in several other animals, which fact is ascribed by the author to the absence of an insulating coat.

The relation between thermic energy and the specific dynamic energy developed on various rations and between the energy used in muscular activity is discussed. The results indicate that during early life there is a reciprocal inter-

change of energy used for muscular activity and that wasted as heat. This interchange is believed due partly to the increased activity of the animals when on a low plane of nutrition and partly to the preferential demand for blood oxygen in the rebuilding of muscular energy. These results led the author to believe that an accurate maintenance ration is difficult or impossible to determine. Although these observations were made with but two animals, reasons are set forth to indicate that the differences noted are peculiar to the breeds rather than to the individuals.

The pig industry and bacon curing in Sweden (*London: Swedish Legation, [1927], pp. 48, pls. 4, figs. 31*).—This booklet contains a description of the methods of raising swine for bacon production in Sweden. The Swedish slaughterhouse system, methods of curing bacon, and Government regulations for the control of slaughter are explained.

Stallion enrollment.—XVII, Report of stallion enrollment board for the year 1928, with lists of stallions and jacks enrolled (*Indiana Sta. Circ. [159] (1928), pp. 44, figs. 2*).—The usual report (E. S. R., 59, p. 566).

Diet for dogs, G. W. Little (*New York: Robert M. McBride & Co., 1929, pp. XIII+260*).—In this treatise the author discusses the feeding of dogs under the following headings: Why diet is important, diet for puppies and young dogs, food in disease, notes to be remembered in feeding, and diets for every canine breed.

[Experiments with poultry at the New Mexico Station] (*New Mexico Sta. Rpt. 1928, pp. 53–56*).—The results of three experiments, two of which have been previously noted (E. S. R., 59, p. 282), are reported.

Poultry management and cost of production.—The same scratch ration was fed to 2 pens of 76 birds each. In addition pen 1 received mash, while pen 2 received no mash. Powdered milk mixed with water was given as the only drink in pen 2, while pen 1 received water only. The production for 6 months beginning February 1 was 8,268 eggs in pen 1 and 8,466 eggs in pen 2. The average cost per dozen eggs was 10.4 and 11.1 cts. in the respective lots. The quality of the eggs produced was the same in both lots.

Cottonseed meal feeding experiment.—This study has been continued as previously except that a pen receiving 30 per cent of cottonseed meal on alfalfa range and a second pen receiving 38 per cent of cottonseed meal on Bermuda grass were added. Again the pens receiving 38 per cent of cottonseed meal produced eggs with dark spots on the yolks, while those receiving 15 per cent of the meal showed no ill effects. The 2 pens which were added also produced eggs with dark spots on the yolks.

A comparison of rations containing 30 per cent of either Oklahoma or New Mexico cottonseed meal showed that the birds fed the Oklahoma meal produced no eggs with cottonseed meal spots, while all the eggs produced on the New Mexico meal ration were heavily spotted.

Egg storage experiment.—In this study it was found that the yolks of stored eggs produced on rations containing 15 per cent or more of cottonseed meal turned black and that many eggs from rations containing 5 per cent of meal also discolored during storage. Cottonseed hulls and cottonseed were also detrimental to the keeping qualities of eggs. Alfalfa range, especially during the winter season, produced eggs that were inferior for storage purposes. Eggs less than 5 days old when going into storage were superior to those over 5 days old. Storing eggs in a warm place before going into storage reduced their keeping qualities. Eggs from farm flocks were inferior to those from commercial flocks. Fertile eggs were worth slightly less than infertile eggs for storage purposes.

Certification of poultry, H. O. STUART (*New Hampshire Sta. Circ. 39 (1929), pp. 4, figs. 3*).—An explanation of the methods of certifying poultry in New Hampshire for the purpose of improving breed characteristics and type and for increasing and maintaining egg production at a high level.

Serological examination of the blood-relationship between wild and domestic ducks, K. SASAKI (*Jour. Dept. Agr., Kyushu Imp. Univ., 2 (1928), No. 4, pp. 117–132, pls. 2*).—Blood serum from two varieties of domestic ducks, five varieties of wild ducks, and from the Chinese goose was injected into rabbits at the Kyushu Imperial University, Fukuoka, Japan, in an effort to determine by means of the precipitin reaction the blood relationship between these species.

It was found that the Japanese duck can be distinguished from the Chinese goose with the corresponding antisera. On the other hand the Japanese and Muscovy ducks can not be distinguished with the corresponding specialized antisera. With the corresponding antisera the Japanese duck can not be distinguished from the wild ducks, but with specialized antisera it can be clearly distinguished from three varieties, and in the same manner the Muscovy duck can be distinguished from the wild form of Japanese duck. The Japanese duck can be distinguished from its wild form by the use of specialized antisera, but the reverse test does not give any distinguishing precipitin.

DAIRY FARMING—DAIRYING

Proceedings of the annual meeting of the American Dairy Science Association (*Jour. Dairy Sci., 11 (1928), No. 6, pp. 527–532*).—A brief résumé of the meetings held at Madison, Wis., June 26–28, 1928, together with the titles of the papers presented in the various sections of the association (E. S. R., 59, p. 165.)

Experiments with hay and some fodders for dairy cows [trans. title], H. WENZEL (*Beret. Forsøgslab. K. Vet. og Landbohøjskoles* [*Denmark*], *126 (1928), pp. 1–58, figs. 3; Eng. abs., pp. 43–45*).—A series of three feeding trials in cooperation with farmers in Denmark to determine the value of hay for milking cows is reported. In the first study meadow hay of average quality had a tendency to increase the fat content of milk when added to a basal ration of roots and oil cakes. Alfalfa hay used instead of meadow hay in the second study increased both the amount of milk and fat produced.

In the third study four groups of cows were fed daily as follows: Lot 1 10 kg. of meadow hay cut the first of June, lot 2 no hay, lot 3 10 kg. of meadow hay cut the middle of May, and lot 4 10 kg. of alfalfa hay cut at the end of May. All of the lots fed hay gave very satisfactory results, and especially was this true of the hay fed in lot 3. Hay cut at this stage of maturity from 1 hectare (2.47 acres) replaced 1,100 kg. of oil cakes, 2,400 kg. of roots, and 3,600 kg. of straw, and the group of cows fed this hay produced 420 kg. more milk and gained 222 kg. more in weight than did those in lot 2.

Pineapple bran for dairy cows, L. A. HENKE (*Hawaii Univ. Quart. Bul., 7 (1928), No. 1, pp. 7, 8*).—Preliminary results of 4 years' study at the university farm, Honolulu, with two pineapple bran mixtures, one containing approximately 33 per cent and the other 66 per cent of the bran, indicated that this feed when properly supplemented with high protein feeds is satisfactory from the standpoint of milk production for dairy cows.

Cottonseed meal as a feed for dairy calves, O. E. REED, C. F. HUFFMAN, and L. H. ADDINGTON (*Jour. Dairy Sci., 11 (1928), No. 6, pp. 488–515, figs. 11*).—Because of the similarity of the symptoms of cottonseed meal injury to those produced when concentrates alone were fed, the Michigan Experiment Station

fed two lots of two bull calves each to study the relationship. Lot 1 received cottonseed meal as the principal source of protein, while lot 2 received corn gluten meal and corn distillers' grain. Both lots received corn and oats and wheat straw ad libitum. The animals were placed on experiment at about 90 days of age and fed skim milk to 180 days of age, and salt was before the animals at all times.

Lot 1 consumed more feed than lot 2 and made more rapid gains at first, but later declined in weight more rapidly than lot 2. Stiffness and swelling around the hock was observed in all the animals. In lot 1 one calf had a convulsion at 287 days of age, another convulsion 7 days later, and died when 350 days old. The other calf in this lot died at 275 days of age without any manifestation of tetany, although the heavy concentrate feeding had impaired its health. Both calves in lot 2 became blind, one at 347, and the other at 293 days of age. Neither calf died from the effects of the ration, but the condition of one animal was so poor that it was killed and the ration of the other changed. The glands of the animals that died or were killed were subjected to a histopathological study which indicated that the optic nerves, kidneys, and liver were the more seriously and frequently infected organs, although the testes of one animal in lot 1 showed considerable cellular infiltration of the intertubular cells.

Further studies were made with two groups of heifer calves, each placed on experiment at approximately 90 days of age and fed skim milk to 150 days of age. Both lots received all the corn silage and timothy hay they would clean up, yellow corn, bone meal, and salt. Up to 150 days of age cottonseed meal was fed at the rate of 0.5 lb. per head per day in lot 1 and linseed meal at the rate of 0.7 lb. in lot 2. After this date the amount of these supplements was gradually increased.

In this phase of the study there was no appreciable difference in the sleekness of coat and pliability of hide, in the rate of passage of food through the digestive tract, or in the consistency of the feces of the two groups of heifers. The results indicate that as much as 2 lbs. of cottonseed meal per day may be fed without injury to calves 5 months old or older when plenty of good hay and silage is also fed.

Tropical dairy cattle, H. V. Metivier (*Trop. Agr. [Trinidad], 5 (1928), Nos. 6, pp. 131–133, pls. 2; 8, p. 188, pl. 1; also in Agr. Jour. Brit. Guiana, 1 (1928), No. 4, pp. 251–258, pls. 4*).—An article in which the author discusses the difficulties of producing clean milk in the tropics, and also the efforts of the Agricultural Department of Trinidad to grade up the native cattle by the use of purebred Holstein bulls.

Milk goat improvement (*New Mexico Sta. Rpt. 1928, pp. 51, 52*).—Continuing this study (E. S. R., 57, p. 74), it was found that the average increase in milk production at 2 years of age of 22 half-blood Toggenburg does over native does was 102.9 per cent, of 28 three-quarter-blood does 118.1 per cent, of 10 seven-eighths-blood does 148 per cent, and of 5 purebred does 168 per cent.

No significant difference in the transmitting ability of 2 purebred Toggenburg bucks was found based on the average production of their daughters.

The variations in milk yields caused by season of the year, service, age, and dry period, and their elimination.—Part IV, Dry period and standardisation of yields, H. G. Sanders (*Jour. Agr. Sci. [England], 18 (1928), No. 2, pp. 209–251, figs. 12*).—In concluding this series of papers (E. S. R., 60, p. 863), the author discusses the effect of the length of the dry period on the total lactation yield. An analysis of the records of all the cows for which the dry period between lactations was known showed that the length of time a

cow was dry had a marked effect upon her yield. Short dry periods were found to have a depressing effect upon production, and this effect was greatest with cows starting their second lactation. This action with young cows suggests that in addition to factors operating on all cows the younger animals make growth during a fair period of rest. The rest period allows the animals to get in good condition for the strain of the next lactation, and also prepares the mammary gland for production, while with the young cows there is also mammary growth at this time. There was no significant difference in the breeds studied as to the effect of the length of dry period, and high and low producing cows varied in the same proportion with these factors.

Throughout the study corrections have been calculated for the four factors involved. These corrections were made to give a standardized figure to the cow and to serve as a basis for comparison. The corrections were found to be applicable to the breeds studied and to high and low producers. It is concluded, however, that the estimate obtained by the application of these corrections is subject to a probable error of 9 per cent in the case of first calvers and 8 per cent in the case of older cows. These estimates, when properly applied, should be of great value in rating the producing capacities of different cows.

Studies in milk secretion based on the variations and yields of milk and butter fat produced at morning and evening milkings, S. BARTLETT (*Jour. Agr. Sci. [England], 19 (1929), No. 1, pp. 36–47, figs. 5*).—Over a 5-year period more than 10,000 samples of milk were tested for fat and 111 complete lactation records of cows were available for analysis at the National Institute for Research in Dairying, University of Reading, England. Of the lactation records, 97 were obtained from Shorthorn cows and 14 from Guernsey cows. The milk samples for testing were taken on three consecutive days and tested by the Gerber method while fresh. The intervals between milkings were about 15¼ hours for the night interval and 8¾ for the day interval.

The analysis shows that smaller proportions of milk and of fat are yielded at the morning milkings in early lactation by all cows, and especially in heifers and high-producing cows with relatively small udders. For these animals it is suggested that some reabsorption of milk takes place during the long night interval. It was found that the morning milking did not respond to factors operating to increase milk production during May and June as much as did the evening milking. Seasonal variations in yield of milk and fat and quality of milk at different seasons of the year are discussed.

The influence of the cow's diet on the fat-soluble vitamins of winter milk, II, J. GOLDING and S. S. ZILVA (*Biochem. Jour., 22 (1928), No. 1, pp. 173–182, figs. 3*).—In a cooperative study by the National Institute of Research in Dairying, Reading, and the Lister Institute, London, England, eight cows were fed varying doses of cod-liver oil to observe its influence on the fat content of the milk and on the antirachitic properties of the butter made from the milk.

The addition of 2 oz. of cod-liver oil per head per day to a ration of grains, silage, and hay had no significant depressing effect on the amount of butterfat produced, nor did it increase the vitamin D content of the butter to any appreciable amount. Larger doses of cod-liver oil had a depressing effect on butterfat production, but did increase the vitamin D content of the butter.

The chemical composition of the milk of cows receiving cod-liver oil (preliminary paper), E. C. V. MATTICK (*Biochem. Jour., 22 (1928), No. 1, pp. 144–149*).—In a preliminary study at the National Institute for Research in Dairying, Reading, England, chemical analyses were made of the milk of four

cows fed for a period of five months on the same basal ration. In addition, two of the cows received cod-liver oil and the other two received peanut oil.

The results showed that the feeding of cod-liver oil resulted in a change in the chemical composition of the milk, especially in the percentage of total calcium. The titratable acidity of the milk from cod-liver oil fed cows was slightly less and the time of coagulation by rennet materially increased over that of the cows fed peanut oil. The total phosphorus and nitrogen content of the milk from cows fed cod-liver oil appeared to be unaffected, but the fat content was lower than in the case of cows fed peanut oil.

Pasteurization and cream line, W. H. Marcussen (*Creamery and Milk Plant Mo., 18 (1929), No. 3, pp. 24–32*).—A report by the laboratory methods committee of the International Association of Milk Dealers on the effect of pasteurization on the cream line. Eleven widely scattered milk plants working independently during four seasons of the year made complete observations on 264 pasteurization runs. For each run 12 cream line observations and butterfat determinations were made. Each pasteurization run covered approximately 1 hour, and the average capacity of each plant was 16,000 lbs. of milk per hour. A minimum pasteurizing temperature of 142° F. was used in some instances and 145° in others.

It was found that the average volume of cream on milk pasteurized at 145° was 13.325 per cent less than the average volume of cream on the same milk pasteurized at 142°. This difference in volume is easily discernible by the average observer.

Fourteenth annual report of the creamery license division, T. H. Binney (*Indiana Sta. Circ. 153 (1928), pp. 23, figs. 3*).—This is the annual report of the creamery license division for the year ended March 31, 1928 (E. S. R., 58, p. 272). A report of the production of dairy products in Indiana, the creameries inspected, the examination of distributors, glassware inspection, revoked licenses, and prosecutions are included. The names of the licensed manufacturing plants in the State are also presented.

The effect of distilled water upon the tendency to colony formation upon petri plates, C. S. Mudge and B. M. Lawler (*Jour. Dairy Sci., 11 (1928), No. 6, pp. 436–445, figs. 11*).—At the California Experiment Station a great variation was found in the number of colonies of bacteria on 75 plates poured 15 at a time from a single dilution of milk prepared of such a bacterial content that the plates should have had 150 to 200 colonies. This resulted in an investigation as to the cause of such variation. A single plate was poured from each of 50 dilution bottles immediately after the dilution was added, the plates incubated at 37° C., and counted after 48 hours. There was no increase in these plates such as occurred when the plates were all poured from the same bottle.

Since fresh milk has a fairly constant pH value and there are more or less typical flora common at this concentration, it was thought that dilution might change the pH and lessen the forces holding the bacteria in clumps. With this in mind, two dilution waters were prepared, one with distilled water and the other with a buffered solution adjusted to pH 6.6. Fifty plates were poured from each dilution. It was found that the coefficient of variation for the plates poured from the unbuffered solution was 67 per cent and from the buffered solution only 17 per cent. Phosphate and peptone buffer solutions were used with substantially the same results.

Distribution and growth of bacteria in butter, O. Rahn and H. H. Boysen (*Jour. Dairy Sci., 11 (1928), No. 6, pp. 446–470, fig. 1*).—In studies with butter at the New York Cornell Experiment Station, the authors believe they have

established the fact that due to the division of moisture in churning into very small droplets a considerable portion becomes sterile. With sour cream butter there were more than 100 such droplets to each bacterium, in which case about 40 per cent of the moisture would be sterile, while with pasteurized sweet cream butter approximately 80 per cent of the moisture would be sterile. The amount of sterile moisture depends upon the number of bacteria present at the time of churning and the degree of dispersion of the moisture in the butter.

The work showed that the formation of acid in the moisture of butter was much slower than in the same amount of moisture as a continuous fluid, but that the percentage of acid formed increased slowly above the theoretical value computed from the amount of moisture which remained infected. This was accounted for by the diffusion of acid from infected to sterile droplets, since the probable difference between the droplets averaged not more than 5μ.

This work indicates that in order to prevent deterioration of butter by bacteria, pasteurized sweet cream should be churned with as few bacteria as possible and worked as much as possible without making it salty. Highly worked butter scored higher after five months of cold storage than butter that had been little worked, but distinctly overworked butter scored no higher than little worked butter. Washing decreases the acid formation in butter more than would be expected from the amount of protein and lactose left in the washed butter. It was assumed that washing did not change the concentration of the small droplets but diluted the large droplets to almost pure water. The conclusions drawn from this work probably do not hold true for molds, which have the ability to force their way from one droplet to another.

Heat coagulation of evaporated milk as affected by mixing different grades of raw milk, B. H. Webb (*Jour. Dairy Sci., 11 (1928), No. 6, pp. 471–478, figs. 3*).—In a study of evaporated milk the U. S. D. A. Bureau of Dairy Industry found that when small quantities of poor quality milk were mixed with larger quantities of good quality milk an evaporated product of uncertain heat stability was produced. The mixing either increased or decreased the initial heat stability, and no method by which the results of such mixing may be determined is available. Similar results were obtained when milk was allowed to age before evaporating or when lactic acid was added. These results suggest that milk has an optimum pH at which value it reaches its maximum heat stability.

Slow development of acidity in cheesemaking, G. F. V. Morgan (*New Zeal. Jour. Agr., 37 (1928), No. 5, pp. 305–308*).—Bacteriological analysis of slow-working cheese curds by the Dairy Division of the New Zealand Department of Agriculture showed the samples to contain certain spore-forming aerobes of the *subtilis-mesentericus* group. In determining the effect of these organisms on the curd, two vats of milk which had been handled in the same manner were made into cheese. One vat was inoculated with a good normal working starter, while the other was inoculated with starter which had been contaminated with organisms of *Bacillus subtilis*. At the time of setting both vats had the same acidity.

Acidity developed to the same extent in both vats during the first 2 hours after setting, but the first vat was ready for salting in 6.5 hours, while the curd in the second vat was 10.5 hours reaching the same stage of maturity. Samples taken at various stages of acidity during the cooking showed a steady increase in *B. subtilis*, and a final sample of the whey when cheddaring showed a very great development of *B. subtilis* and also an increase in the virility of *Streptococcus lactis*.

This study shows that *B. subtilis* can live and grow beside an active culture of *S. lactis*. A study of the biological characteristics of *B. subtilis* shows that it

is capable of producing marked alkalinity of milk, followed by an alkaline peptonization of casein with the production of ammonia. These activities of *B. subtilis* account for the weak spongy characteristics of the slow-working curds.

Practical cheesemaking, C. W. WALKER-TISDALE and W. E. WOODNUTT (*London: George Allen & Unwin, 1928, rev. and enl., pp. 204, pls. 16, figs. 18*).—A revised and enlarged edition of this treatise, previously noted (E. S. R., 42, p. 270).

Abstracts of literature on the manufacture and distribution of ice cream (*Harrisburg, Pa.: Internatl. Assoc. Ice Cream Manfrs., 1928, vol. 2, pp. [2]+XIII+178+[1]+IV+46, figs. 13*).—The second volume of this series of abstracts of the literature concerning ice cream (E. S. R., 58, p. 573) to which are appended tables and statistics of daily or frequent use in the operation of an ice cream plant.

VETERINARY MEDICINE

[Work in veterinary medicine] (*Philippine Bur. Agr. Ann. Rpt., 27 (1927), pp. 83–92*).—This report includes an account of control work with animal diseases, particularly rinderpest, followed by an account of the work of the Veterinary Research Laboratory, in which the preparation of rinderpest vaccine and studies of other diseases are considered.

[Annual administration report of the Madras Civil Veterinary Department for the years 1926–27 and 1927–28] (*Madras Civ. Vet. Dept. Ann. Admin. Rpts. 1926–27, pp. 73+7, pls. 5; 1927–28, pp. II+80+8, pls. 6*).—These two reports, the former by D. A. D. Aitchison et al. and the latter by F. Ware et al., are in continuation of those previously noted (E. S. R., 57, p. 872).

[Annual reports of the Civil Veterinary Department, United Provinces, for the years ended March 31, 1924–1927] (*United Provs. [India] Civ. Vet. Dept. Ann. Rpts., 1924, pp. [2]+II+25+2, pl. 1; 1925, pp. [2]+II+27, pl. 1; 1926, pp. [3]+II+29, pl. 1; 1927, pp. [3]+II+26, pl. 1*).—The usual annual reports (E. S. R., 52, p. 280) for the years ended March 31, 1924, 1926, and 1927 by S. G. M. Hickey, and for 1925 by W. H. Priston.

Drymaria pachyphylla (*New Mexico Sta. Rpt. 1928, pp. 60–62*).—In losses of cattle reported from the southern portion of the State the various causes assigned led to a search for suspected plants, one of which, *D. pachyphylla*, proved to be quite toxic. It was found to be poisonous not only when growing but also after the frost had killed it and it was drying up. The greatest losses, however, occurred in August, September, and October. The tests made at several points in the State have shown all parts of Drymaria above ground to be poisonous at all stages of maturity. In attempting to feed this weed to cattle it was found to be quite unpalatable. When left to eat it alone, the cows would starve rather than eat the Drymaria.

Observations on the hydatid parasite (Echinococcus granulosus) and the control of hydatid disease in Australia, I. C. ROSS (*Aust. Council Sci. and Indus. Research Bul. 40 (1929), pp. 63, figs. 4*).—The main part of this work is considered under the headings of observations on the morphology and bionomics of *E. granulosus* (Batsch 1786) Rudolphi 1805 (pp. 6–25), the incidence of hydatid disease in Australia (pp. 25–46), and control of hydatid disease (pp. 46–57).

A very high incidence of hydatid disease was found in cattle and sheep in certain areas in New South Wales. A very high incidence of the adult worm in the dog has been found in country districts, two classes of dogs, namely, those at slaughter yards and on sheep stations, being most heavily infested.

Infestation of the dingo and fox occurs naturally but of the cat only very rarely. "It is considered that the most important factor in producing infestation of the dog in Australia is the large sheep population and the widespread habit of feeding raw viscera of these animals to the dog. It is not thought that cattle, pigs, or rabbits are comparable in importance to the sheep as a source of infestation. Infestation of man is most frequently caused by the careless handling of infested country dogs, this being largely due to the widespread ignorance of the true nature of hydatid disease and its method of spread. Flies have been found capable of ingesting Echinococcus eggs, and are thought to be possible carriers of infestation to man. Infestation through drinking water or by the ingestion of raw vegetables is not thought to be of great importance in Australia as was previously supposed."

The reaction of complement fixation in foot-and-mouth disease as a means of identifying the different types of virus, A. CIUCA (*Jour. Hyg.*, *28 (1929), No. 4, pp. 325–339*).—The author reports upon experiments conducted with the three known types of virus of foot-and-mouth disease and a large number of sera from guinea pigs, including the sera from 155 animals recently recovered from the disease, from 117 hyperimmunized animals, and from 73 which were normal. The results obtained with guinea pigs suggest that it may be possible to use the complement fixation method for determining the type of foot-and-mouth disease virus in other animals.

A list of 29 references to the literature is included.

Malta fever: A laboratory infection in the human, W. L. MOSS and M. CASTENADA (*Assoc. Amer. Physicians, Trans.*, *43 (1928), pp. 272–284, figs. 5*).—This is a general report of Malta fever in man. A case of undulant fever occurring in Boston, Mass., which is reported, was found to be due to *Brucella melitensis paramelitensis*.

Malta fever occurring among personnel in United States Veterans' Hospital, Knoxville, Iowa, C. A. KEARNEY (*U. S. Veterans' Bur. Med. Bul.*, *5 (1929), No. 4, pp. 259–262*).—This is a detailed report of three cases of undulant fever observed among the employees of the U. S. Veterans' Hospital at Knoxville, Iowa, in which emphasis is placed upon some of the most salient clinical features and attention is called to the prevalence of the disease.

Human infection by Bacillus abortus and related organisms, L. C. ELLEDGE (*U. S. Veterans' Bur. Med. Bul.*, *5 (1929), No. 4, pp. 263–265*).—This account relates to the cases reported upon by Kearney, above noted.

Brucella abortus infection in man, A. S. GIORDANO and M. ABLESON (*Jour. Amer. Med. Assoc.*, *92 (1929), No. 3, pp. 198–201*).—This is a report of agglutination tests made for *B. melitensis* in a series of 1,100 specimens of blood at South Bend, Ind. One thousand of these were from patients who presented themselves for diagnosis or treatment of some chronic or acute illness, and 100 were taken for comparison from apparently healthy young adults.

"In the first group there were discovered 14 active cases of undulant fever, apparently of the abortus type. These active cases present a varied clinical picture that demands more serious consideration by clinicians than has been heretofore given in America. In the 1,100 cases the test was positive 63 times (5.7 per cent); in the 1,000 cases of acute or chronic illness it was positive 59 times (5.9 per cent); and in the 100 control cases it was positive 4 times (4 per cent). The incidence in a group apparently tuberculous was 8 per cent. There is a surprisingly small variation of incidence in the three groups."

The pig and undulant fever (*Jour. Amer. Med. Assoc.*, *92 (1929), No. 11, p. 901*).—This brief account calls attention to the importance of the porcine strain of *Brucella abortus*, the cause of undulant fever (Bang) in man. Refer-

ence is made to three cases occurring in Connecticut, reported by F. G. Blake and H. C. Oard,[3] that were due to the porcine variety.

The differentiation of Brucella melitensis and B. abortus by their agglutinins [trans. title], J. VIDAL and R. ABELLA (*Compt. Rend. Soc. Biol. [Paris], 99 (1928), No. 29, pp. 1271–1273*).—In studies of agglutinins none of the methods employed was sufficient to distinguish between these two organisms.

Filterable virus and Rickettsia diseases in the Tropics.—I, A general review, E. B. MCKINLEY (*Porto Rico Rev. Pub. Health and Trop. Med., 4 (1929), No. 7, pp. 281–298*).—This is a general review presented in connection with a list of 70 references to the literature.

Changes in the blood of cats infected with Trypanosoma equiperdum, J. ANDREWS and E. P. SANDERS (*Amer. Jour. Hyg., 8 (1928), No. 6, pp. 947–962, figs. 5*).—The authors find that changes in the blood during the course of the infection of cats with *T. equiperdum* consist of progressive anemia, general leucopenia, and terminal hypoglycemia. A list of 25 references to the literature is included.

Tularemia, C. W. O. BUNKER and E. E. SMITH (*U. S. Naval Med. Bul., 26 (1928), No. 4, pp. 901–911*).—This is a report of four cases, one of which resulted fatally, followed by a discussion based upon the data presented.

Tularemia (Francis's disease), W. M. SIMPSON (*U. S. Naval Med. Bul., 26 (1928), No. 4, pp. 825–833, pls. 5, fig. 1*).—A summary of information on this disease presented in connection with a list of 19 references to the literature.

The physiology and pathology of the forestomachs of cattle, J. WESTER (*Die Physiologie und Pathologie der Vormägen beim Rinde. Berlin: Richard Schoetz, 1926, pp. 110, figs. [62]*).—The first part (pp. 5–50) of this account deals with the physiology and the second part (pp. 51–110) with the pathology of the forestomachs of cattle.

Infections with Bacillus abortus Bang (*Jour. Amer. Med. Assoc., 92 (1929), No. 3, p. 246*).—Reference is made to several cases of *B. abortus* infection reported by Spengler where the disease did not develop for from two months to two years after exposure and then only as a result of other infections.

Investigations on anaplasmosis in cattle, G. W. STILES (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 5, pp. 704–723, figs. 3*).—This is a report of investigations conducted by the author for the U. S. D. A. Bureau of Animal Industry during a period of several months in Kansas and Oklahoma, where it is believed that a death loss of approximately $1,000,000 was suffered during 1927. It is thought that the disease has been introduced into this country from tropical regions by means of carriers.

The mortality was found to vary in different herds, the average death loss being estimated at about 4 per cent of the afflicted animals. The symptoms and autopsy findings are similar to those of Texas fever, but fever ticks are absent, and other factors help differentiate the two diseases. No specific treatment is available, although the use of various arsenical preparations early in the disease appears of value. Numerous insects, including ticks, other than the Texas fever tick, biting flies, mosquitoes, lice, mites, and other carriers of disease are under consideration, but as yet the specific vector has not been determined. A preliminary account has been noted (E. S. R., 59, p. 369).

Longevity of Anaplasma marginale and Theileria mutans of Tunisian origin in the blood of a cow [trans. title], E. BRUMPT (*Ann. Parasitol. Humaine et Compar., 7 (1929), No. 1, pp. 55, 56*).—A mixed infection of *T. mutans* and *A. marginale* was found in the blood of a cow 6 years 8 months after it had been inoculated with a mixed virus containing *Piroplasma bigemi-*

[3] Yale Jour. Biol. and Med., 1 (1929), p. 128.

num, P. argentinum, T. mutans, and *A. marginale.* In a direct examination of blood smears 7 years 4½ months after the inoculation *T. mutans* was readily detected.

Experimental studies of bovine leukemia, G. T. Creech and H. Bunyea (*Jour. Agr. Research* [*U. S.*], *38* (*1929*), *No. 7, pp. 395–404, figs. 8*).—This detailed report of studies of a case of leukemia includes references to the literature. Following a brief introduction, an account is given of the origin and history of the case studied, clinical examination, blood counts, autopsy findings, tissues cultured, histopathology, and animal inoculations.

The very marked and definite change in the numerical ratio of the blood cells, as demonstrated by a number of cell counts, together with the typically leukemic changes noted histologically, are considered sufficient evidence that the disease of the cow studied was true leukemia. Bacteriological studies made of the affected tissues of the leukemic cow gave negative results. All efforts to transmit the disease to other animals of the same and different species, by inoculations of blood and glandular material from the affected animal, likewise gave negative results. The experimental studies gave no evidence that bovine leukemia is of infectious origin.

The blood in the therapy of parturient paresis [*trans. title*], B. Sjollema (*Tijdschr. Diergeneesk.*, *55* (*1928*), *Nos. 20, pp. 1017–1036; 21, pp. 1085–1105; 22, pp. 1121–1132; 23, pp. 1187–1205; Ger., Eng., Fr. abs., pp. 1200–1204*).—A report upon studies of the blood which have shown that mineral metabolism is disturbed in milk fever. It is concluded that a deficiency of the parathyroid gland is the direct cause of milk fever, i. e., of the sudden appearance of the symptoms of the disease. This deficiency manifests itself when the calcium metabolism is called upon to meet greater demands, especially when the ovarian functions are increased. The calcium percentage of the blood serum is in most cases about 5 mg. In various species of animals there are manifestations of tetany already at 7 or 7.5 mg.

That the calcium deficiency plays an important rôle in the onset of milk fever may be concluded from the rapid recovery of more than 20 cows by the intravenous injection of 300 to 400 cc. of a 10 per cent solution of crystallized calcium chloride. In a few other cases, in which there was a transient recovery, a relapse occurred in 24 hours or later. After mammary inflation there was an increase in the percentage of calcium which also points to the significance of the calcium deficiency. With about 30 milking cows suffering from analogous diseases the calcium chloride injection had the same effect. It is recommended that the calcium chloride action be supported by the addition of 1 to 2 mg. adrenalin, 50 to 60 gm. glucose, 10 to 20 mg. atropin, or an extract of the parathyroid. The view that an insufficiency of the parathyroid gland is the immediate cause of the symptoms is supported by the favorable result of parathormon. The author concludes that the calcium chloride therapeutics are always to be recommended in cases where functional disturbances cause paresis, collapse, or cramps. Experiments on prophylactic treatment have not as yet given a definite result.

"Red water" in cattle (*Jour. Amer. Med. Assoc.*, *91* (*1928*), *No. 25, p. 2004*).—An account of a disease which has practically wiped out a dairy herd of 68 cows near Abbotsford, B. C., in the last 8 years.

The relation of acid-fast skin infections of cattle to bovine tuberculosis and other acid-fast infections, J. Traum (*Jour. Amer. Vet. Med. Assoc.*, *74* (*1929*), *No. 4, pp. 553–575*).—This is a detailed report, largely in tabular form, of the results of inoculation of animals at the California Experiment Station with the suspected material. A review of the literature and a detailed case

report are followed by discussions of hypersensitiveness of skin-lesion cases to tuberculin, animal inoculations with skin lesions, acid-fast organisms isolated from skin lesions, and tests with culture filtrate.

It is pointed out that while the finding of acid-fast rods in tuberculosis-like lesions in tuberculin-reacting cattle at once suggests bovine tuberculosis, the acid-fast organisms, with few exceptions, have not induced experimental tuberculosis in the animals injected with tissue emulsions. Culture media sown with skin-lesion tissue containing acid-fasts have thus far given negative results.

The importance of a proper classification of organisms inducing the skin lesions, now lacking, is considered essential. It has been found that acid-fast organisms can not be definitely classified by their morphology or staining reaction. Hypersensitiveness to tuberculin is considered good supporting evidence that lesions may be induced by mammalian tubercle bacilli, but this is not conclusive, since the group reactions with acid-fast organisms must be considered.

"The few successful experimental productions of tuberculosis with these lesions is proof that skin and subcutaneous tuberculosis exist in cattle, but can not unequivocally be accepted as proof that all the other cases studied (roughly estimated to be 95 per cent) were also induced by bovine tubercle bacilli. There is at present no available experimental evidence to show that bovine tubercle bacilli lose their power to produce lesions and to grow on suitable media soon after they are placed under the skin of cattle."

Studies concerning the Calmette-Guerin method of vaccinating animals against tuberculosis, E. C. SCHROEDER and A. B. CRAWFORD (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 5, pp. 733–782*).—In the authors' studies B.C.G. has been shown to be a mammalian tubercle bacillus of very low virulence, if not avirulent. A tuberculin comparable in potency to a standard tuberculin was prepared from the growth on liquid medium. It was found that guinea pigs inoculated intraperitoneally with B.C.G. manifest a marked sensitization to mammalian tuberculin. Immunization experiments in guinea pigs showed a marked prolongation of life in animals treated with B.C.G. over untreated animals, when both groups were subjected to tuberculous exposure. Vaccination did not result in immunity, however, as every vaccinated animal died eventually of tuberculosis.

"Cattle vaccinated with B.C.G., with an equal number of controls, were exposed to tubercle bacilli by intravenous injection, subcutaneous injection, feeding, and contact with known tuberculous animals. In the group where exposure was made by feeding virulent tubercle bacilli, the vaccinated cattle showed more extensive lesions, as a whole, than the unvaccinated. In the three other groups resistance to the localization and generalization of tuberculosis was slightly more manifest in the vaccinated than in the unvaccinated animals, but in no group was there manifest an immunity as measured by the prevention of infection. Thus, vaccination with B.C.G. does not appear to prevent virulent tubercle bacilli from entering the body and establishing foci of infection, but merely inhibits the extension of tuberculous processes."

The results are considered to indicate clearly that vaccination of cattle with B.C.G. has no value as a means of eradicating tuberculosis in livestock.

A two-year experiment with the "Calmette" method of vaccination, W. P. LARSON and W. A. EVANS (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 4, pp. 581–585*).—The authors' work indicates that the Calmette-Guerin (B. C. G.) method of vaccination has no value whatever in cattle. The carrying out of a further experiment on a somewhat larger scale, using the killed organism, is thought to be justified.

Effect of Calmette's BCG vaccine on experimental animals, M. J. KING and W. H. PARK (*Amer. Jour. Pub. Health, 19 (1929), No. 2, pp. 179–192, figs. 8*).—The authors were able to produce small discrete nonprogressive tubercles in guinea pigs and monkeys which were vaccinated subcutaneously and intraperitoneally with B.C.G. In no instance were these lesions reproduced upon guinea pig subinoculation. After subcutaneous injection of the vaccine they were able to demonstrate progressive tuberculosis in one guinea pig. They were unable to account for this occurrence, but suggest that it depended upon some individual susceptibility of the animal.

So far as the feeding results go in newborn guinea pigs and calves, no evidence has been shown of infection with the vaccine nor of protection by it in the guinea pigs. Two of the 8 calves in this group did, however, show evidence of protection. In fairly young but not newborn monkeys, on the other hand, there was evidence of slight absorption. Four monkeys out of 9 which were fed the vaccine were found at autopsy to have localized tubercles, usually in the mesenteric nodes.

These findings indicate that the bacilli in the vaccine may pass the mucous membrane of the intestinal tract of monkeys. The fact that inoculation of these tubercles into normal guinea pigs failed in every case to infect indicates the successful attenuation of the authors' B.C.G. cultures when grown continuously on the bile medium of Calmette. However, they do not feel justified in drawing conclusions as to the absolute safety of the B.C.G. vaccine until further experimentation has been done covering a period of years on vaccinated animals. They emphasize strongly the importance of continuous cultivation of the B.C.G. on the bile medium.

The impossibility of infecting normal calves by feeding what the authors consider infective doses of virulent cultures shows the necessity of sufficient controls. Without these the lack of infection in the vaccinated animals would have indicated immunization although it simply showed the difficulty of infecting them through the intestinal tract.

While vaccinated animals which were later infected with virulent organisms were found as a rule to develop more or less progressive tuberculosis, they generally developed the disease to a lesser extent than nonvaccinated controls which received the same injections of virulent organisms.

Some obscure diseases of sheep, H. MARSH (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 5, pp. 724–735*).—The author here deals with preparturient eclampsia, stiff lambs, progressive pneumonia, bighead, and tick paralysis.

Observations on Gastrocystis gilruthi, a parasite of sheep in Britain, M. J. TRIFFITT (*Protozoology, No. 1 (1925), pp. 7–18, pls. 2, figs. 2*).—The author confirms and supplements the observations of Chatton, previously noted (E. S. R., 25, p. 589), and gives an account of some experiments undertaken in an attempt to further elucidate the life history and systematic position of the parasite.

Further observations on the development of Globidium gilruthi, M. J. TRIFFITT (*Protozoology, No. 4 (1928), pp. 83–90, figs. 4*).—This supplements the account above noted.

A strain of Bacillus abortus from swine, T. SMITH (*Jour. Expt. Med., 49 (1929), No. 4, pp. 671–679*).—The author reports upon an outbreak of infectious abortion in swine met with in the herd of a State institution. It was associated with a strain of *B. abortus* growing rapidly on ordinary nutrient agar slopes without seal and presenting certain slight pathological deviations from the bovine form of disease in guinea pigs, such as the occurrence of necrotic, suppurating foci in spleen and lymph nodes.

"Agglutination tests, comprising both cross-agglutination and absorption procedures, failed to distinguish the strain from the bovine type. The gross ap-

pearance of the fetuses from this outbreak was normal. The shreds of placentas obtainable indicated slight erosion of the chorionic epithelium and some exudation. The specific bacilli were quite widely disseminated in the tissues of the fetuses. The pathogenic action of this swine strain on guinea pigs was evidently much feebler than that of most earlier swine strains as reported, and it approached more closely that of bovine strains. The culture fed to a pregnant sow failed to produce abortion, possibly because of the advanced stage of pregnancy. The organism was not recovered from the uterus, but was found in the sow's milk."

Swine pox, S. H. McNutt, C. Murray, and P. Purwin (*Jour. Amer. Vet. Med. Assoc.*, *74* (*1929*), *No. 5, pp. 752–761, figs. 6*).—This is an account of swine pox which was found to occur in approximately 1 per cent of the herds represented in the course of the routine diagnosis of swine diseases at the veterinary laboratory at the Iowa State College.

Diagnosis of equine infectious anemia by use of the fowl [trans. title], Oppermann and Lauterbach (*Deut. Tierärztl. Wchnschr.*, *36* (*1928*), *Festschrift, pp. 61–69, pl. 1, figs. 2; abs. in Rev. Gén. Méd. Vét.*, *38* (*1929*), *No. 446, pp. 80, 81*).—The authors find that when the serum from a case of equine infectious anemia is injected into the fowl intramuscularly no clinical symptoms appear, but that lesions are produced in the liver which have a positive diagnostic significance.

When fowls are examined seven days after inoculation and sections of the liver are studied, lesions are found, characterized by infiltrations of round cells and deposits of hemosiderin, that can not be reproduced by the injection of serum from a healthy horse. Neither does tuberculosis, fowl cholera, nor pullorum infection produce similar lesions. The virus of infectious anemia of the horse apparently has the property of irritating the reticulo-endothelial system (venous capillaries) of the liver of the fowl, causing the destruction of numerous red cells and producing hemosiderosis.

Bacillus aertrycke, the possible causative bacillus of canine typhus (Stuttgart dog disease), J. A. Manifold (*Jour. Roy. Army Med. Corps*, *51* (*1928*), *No. 6, pp. 402–409*).—The author reports *B. aertrycke*, apparently for the first time, as having been recovered from the dog. Agglutinins of the organism were found to be present in the serum of two pariah dogs. It is suggested that this organism may be the cause of canine typhus, and that in its subacute form it is common in India and often diagnosed as tick fever.

Kamala, an anthelmintic for removal of tapeworms in bears, T. Vergeer (*Jour. Amer. Vet. Med. Assoc.*, *74* (*1929*), *No. 5, pp. 786–788*).—In the course of investigations of the broad tapeworm of man (*Diphyllobothrium latum*), two bears were experimentally infested with this parasite, and treated with kamala. The results indicate that if food is withheld for some time previous to treatment kamala is a good tasteless anthelmintic for the removal of tapeworms from bears. It lacks undesirable poisonous and dangerous qualities and is self-sufficient in purgative action. Anthelmintic treatment with kamala is most simple and easy, and because it saves labor it is also the most economical treatment.

Bacillary white diarrhea, P. R. Edwards and F. E. Hull (*Kentucky Sta. Circ. 40* (*1928*), *pp. 15, figs. 4*).—This is a practical summary of information on bacillary white diarrhea in which particular attention is given to means of prevention.

Concerning methods of testing fowls for bacillary white diarrhea, J. R Beach (*North Amer. Vet.*, *10* (*1929*), *No. 3, pp. 54–56*).—A brief practical discussion of the slow and rapid agglutination and the intradermal or pullorin test for pullorum infection.

Control of bacillary white diarrhoea infection of poultry in British Columbia, J. BIELY (*Sci. Agr., 9 (1929), No. 7, pp. 413–422*).—This is a report of investigations conducted by the departments of bacteriology and poultry husbandry of the University of British Columbia under a grant from the Canadian National Research Council. Fifteen of 41 flocks from which specimens were received were found to be infected, and *Salmonella pullorum* was isolated from chicks in 13 of the infected 15. The infection of adult birds was found in 25 of 41 largely additional flocks containing 15,327 birds to which the agglutination test was applied. Of these birds 11.3 per cent reacted to the agglutination test.

The infection was found to be introduced into the flocks or further spread within the flocks by (1) the introduction of infected breeding stock, (2) purchase of day-old chicks from infected flocks, and (3) feeding of raw eggs from infected birds. The agglutination test was found to be highly effective in detecting infected birds, as shown by the reduction in the percentage of infection after removal of reactors following a single test. The disease was found to have caused heavy losses among chicks, and marked improvement in livability of chicks followed the removal of reactors from infected flocks.

It is concluded on the basis of the data here presented that the disease can be effectively controlled by the application of the agglutination test.

Transmission of fowl-pox by mosquitoes, I. J. KLIGLER, R. S. MUCKENFUSS, and T. M. RIVERS (*Jour. Expt. Med., 49 (1929), No. 4, pp. 649–660, pls. 4*).—This is a contribution from the Hospital of the Rockefeller Institute for Medical Research in which experiments are reported showing that mosquitoes of the genera Culex and Aedes are capable of transmitting fowl pox from diseased to healthy susceptible chickens. They are capable of such transmission at least during the first 14 days following the infective meal, tests at intervals longer than 2 weeks not having been made. Thus, the total duration of the infectiousness of the insects remains to be determined.

It is pointed out that in view of the fact that the virus is active in minute quantities and is highly resistant to drying, the results of the experiments can be explained entirely upon the grounds that the mosquitoes mechanically transmit the disease without the occurrence of any multiplication of the virus in the insects. The indications are that these insects may play an important rôle in the rapid and thorough infestation of flocks under natural conditions.

A list of 17 references to the literature is included.

Vaccination against fowl pox, A. BROERMAN and B. H. EDGINGTON (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 5, pp. 762–767*).—In vaccination work in Ohio the author found the feather follicle method of vaccination to produce an immunity equally satisfactory to that of cutaneous scarification, the results thus obtained confirming those reported by other investigators. The cutaneous method of vaccination, either by scarification of the skin or by plucking several feathers, has been found to produce an immunity which withstands attempts at severe artificial infection.

It is concluded that healthy young fowls from 4 to 7 months of age may be vaccinated without danger of causing a harmful chicken-pox infection. All susceptible fowls on the premises should be vaccinated. Vaccination of pullets while on range and before the combs are fully developed is recommended.

It is pointed out that the use of a vaccine on a farm where fowl pox has never existed is not advisable, especially when conditions are such that the infection is not likely to be introduced.

Experimental studies of bird malaria, R. HEGNER (*Quart. Rev. Biol., 4 (1929), No. 1, pp. 59–82, figs. 13*).—An extended report on studies of this disease of the bird presented in connection with a list of 34 references to the literature.

Infection and immunity in bird malaria, W. H. TALIAFERRO (*Porto Rico Rev. Pub. Health and Trop. Med., 4 (1928), No. 4, pp. 155–168, figs. 4*).—The subject is discussed under the headings of the parasite and the infection produced, the antiparasite resistance of the host, host resistance through the infection, and relapses.

Newcastle disease: A new fowl pest [trans. title], J. VERGE (*Rev. Gén. Méd. Vét., 38 (1929), No. 445, pp. 11–14*).—This is a summarized account of the new disease described by Doyle (E. S. R., 58, p. 77).

Fowl typhoid, G. MARTINAGLIA (*Farming in So. Africa, 3 (1929), No. 35, pp. 1267, 1270, fig. 1*).—A practical summary of information on this disease, the mortality from which is generally high in South Africa, varying from 15 to 85 per cent.

AGRICULTURAL ENGINEERING

Agricultural engineering, B. J. OWEN (In *Agricultural Research in 1927. London: Roy. Agr. Soc. England, 1928, pp. 77–115*).—A review of outstanding progress in agricultural engineering during 1927 is presented from the British viewpoint.

Land drainage and reclamation, Q. C. AYRES and D. SCOATES (*New York and London: McGraw-Hill Book Co., 1928, pp. VIII+419, figs. 283*).—This book deals with the drainage, reclamation, and surveying problems that arise on the average farm, many of which the farmer himself can handle. It is based largely on experience at the Iowa State College and the Texas Agricultural and Mechanical College and at a number of other land-grant and Federal institutions.

An effort is made at the outset to acquaint the reader with the broad aspects of land reclamation, and in the chapters on surveying the use of the level and tape is treated at some length. The compass and its use in land surveying are also discussed in detail.

In the surface-drainage portion of the text considerable attention is devoted to the drainage district, this chapter being a contribution from the U. S. D. A. Office of Experiment Stations. Considerable space is also devoted to terracing, land clearing, and legal principles relating to farm waters.

Other chapters are included on drainage properties of soils, rainfall and run-off, open-ditch design, open-ditch location and construction, open-ditch maintenance, earth dams and levees, explosives and their use, subsurface drainage, location of tile drains, design of tile drains, selection of tile, installation of tile, draintile accessories, estimating cost of tile drainage, special methods of drainage, and practical tile-drainage problems.

[Irrigation and drainage investigations at the New Mexico Station] (*New Mexico Sta. Rpt. 1928, pp. 16, 17, 23–31, fig. 1*).—The progress results of a number of irrigation studies conducted in cooperation with the U. S. D. A. Bureau of Public Roads are briefly summarized. These relate to ground water studies in the Middle Rio Grande Valley; duty of water; rate and cause of rise of ground water in the Mesilla Valley; duty and effect of duty of water on alfalfa; water requirements and the economical use of water for cotton and other crops; and rainfall supplemented by underground water in the production of crops of low water requirements. Analyses of waters entering the Rio Grande and of waters drawn from that stream for irrigation purposes indicate that "downstream there is an increase in the concentration of alkali. . . . Since the concentration of alkali increases at the period of low water when little irrigation water is being used, it does not appear advisable to decrease the total amount of water used annually for irrigation. Below the Courchesne

Bridge the sum of the sodium and potassium exceeds the calcium and magnesium. This increase is attributed to white alkali from the drainage waters.

"A survey of two other streams was made to determine whether or not the waters were contaminated with copper, lead, or zinc from mines and concentration mills. These waters were found to be free from harmful amounts of these substances."

Suggestions concerning small irrigation pumping plants, W. E. Code (*Colorado Sta. Bul. 350 (1929), pp. 22, figs. 7*).—Practical information is given on the designing of small irrigation pumping plants and on the improvement of present installation.

Experiments to determine rate of evaporation from saturated soils and river-bed sands, R. L. Parshall (*Amer. Soc. Civ. Engin. Proc., 55 (1929), No. 4, pt. 1, pp. 843–854, figs. 4*).—In a contribution from the Colorado Experiment Station a description is given of studies of the evaporation loss from soils contained in tanks under like exposure, the soils ranging from coarse river sand to heavy dark alkaline soil, with the water table maintained at 1, 6, and 12 in. beneath the surface. It is not the intention to present conclusive data as to the loss by evaporation from moist soil surfaces, but rather to describe the methods and procedure followed and submit such information as is now available as an indication of the general trend of the relations existing between the various soils and conditions, as well as supporting the general conclusions drawn.

Covers were provided to protect the tanks against rain, but nearly every week more or less rain fell on the exposed soil surfaces. Experience with these tanks shows that a marked reduction in the evaporation loss occurs when the covers are in place. The cooling effect of the rain on the soil increases the surface tension of the capillary moisture drawn up from the water table. Rain water falling on the soil also dilutes the soil solution, and if the solution is alkaline it increases the rate of evaporation. It is evident that, although adding moisture to the soil at the time, light showers may later cause a more rapid depletion of the moisture already within the soil.

With reference to the trend of evaporation loss from different soils with increasing depth of water table, it was found that the four river samples of fine sand with the water table at 1 in. show a loss equal to that from a free water surface. The loam and heavy adobe soils show a loss of 83 and 75 per cent, respectively, for a depth of 1 in. to the water table, as compared with that from free water. When the water table is 6 in. below the soil surface, the Rocky Ford sand and the adobe soil show a reduction of loss, while the loam soil and both the medium and coarse river sands show a loss equaling that from the free water surface.

"It is believed that the method of using the Mariotte principle in obtaining the evaporation loss from moist soils, even though there are some apparent inconsistencies in its operation, gives more dependable results than the method of weighing. The results . . . show very marked consistency for fine river sands, which are essentially identical, with the exception of the silt content. Those cited are in evidence of the dependability of the apparatus. The feature of automatic control is highly desirable."

Some physical aspects of organic matter, C. A. Bacon (*Agr. Engin., 10 (1929), No. 3, pp. 83–85, figs. 6*).—The results of a large number of tillage experiments emphasizing the physical aspects of soil organic matter are briefly summarized.

Studies over a period of eight years of the packing of soil by tractor wheels revealed a correlation between the amount of organic matter the soil contained

nd the degree of injury the packing did. The field investigations began with he study of the influence of packing on muck soils. On freshly broken virgin eat soils the action of the tractor wheels packing the ground when making the eed bed proved beneficial to crop growth. Some of these soils contained as igh as 90 per cent of organic matter.

The investigation in clay fields, where the clay element comprised from 70 o 90 per cent, showed that in soils containing less than 1 per cent of organic natter packing by tractor wheels caused serious injury. On dry soil the furow following the tractor wheel was broken and differed from the other furrows in shape and texture. Rainfall caused the finer earth particles of this furrow to run together to such an extent that after-tillage operations did not prevent curtailment of plant growth. Plowing these same soils when wet made the ground so hard that no amount of after-tillage effectively offset the injury to crop growth. A winter's freezing proved necessary to soften the hard clods. The addition of organic matter to a 6 per cent content to a depth of 11 in. showed no crop growth injury from the packing of tractor wheels in the same soils when plowed dry or in moist condition. The injury to crop growth after wet plowing was greatly reduced.

Sandy soils containing 90 per cent of sand and less than 1 per cent of organic matter were injured by the packing of the tractor wheels. When the content of this soil was increased to 3.5 per cent organic matter to a depth of 8 in., the packing of the tractor wheels proved to be of benefit to the soil. A still further increase in organic matter up to 6 per cent to a total depth of 11 in. resulted in the influence of packing of tractor wheels as being nil.

In plow draft studies the constantly increasing content of organic matter in the soil, regardless of its nature, showed a corresponding decrease in the amount of power required to pull the plow, whether the ground was dry and hard or the conditions optimum for ideal plowing.

Studies of plow scouring showed that the correction of soil acidity by liming and increasing the organic matter content corrected a nonscouring condition regardless of the size or shape of the plow.

The quality of Appalachian hickory, B. H. Paul (*South. Lumberman, 135 (1929), No. 1749, pp. 29–32, figs. 9*).—In a contribution from the U. S. D. A. Forest Products Laboratory the results of a quality survey of mechanical tests of Appalachian hickory are briefly reported.

A high percentage and in general, the average strength of the Appalachian hickory compares favorably with that from other parts of the country. All Appalachian hickory, however, does not have sufficient strength to meet the requirements of the customary uses of hickory. The second-growth Appalachian hickory which was tested was as high in shock-resisting properties as any hickory previously tested from other parts of the United States.

In the Appalachian region the hickory of low strength was principally in the outer portion of the bole of old virgin-growth trees. Such material was of slow growth and low specific gravity. It usually included all of the sapwood (white hickory) and sometimes a portion of the heartwood. The clear heartwood (red rickory) of the trees of Appalachian forests was usually of good strength.

Hickory having fairly uniform weight and strength was found in trees that had sustained their growth rate from the center outward or in trees that had been sufficiently vigorous to increase their growth rate. A slowing of the growth rate at any period in the life of the hickory trees was accompanied by the production of wood of lower strength.

The high shock-resisting properties of the second-growth Appalachian hickory indicate that the hickory of this region is not inherently of low mechanical strength.

Tests of green-cut western cedar poles, R. S. Perry and T. A. McElhanney (*Canada Dept. Int., Forest Serv. Circ. 21 (1927), pp. 8, fig. 1*).—The results of a number of mechanical tests are reported which dealt with green-cut sound western cedar poles and with small test specimens cut from them after breaking.

The results indicate that the number, extent, and location of defects has a noticeable effect on the strength of the pole as a unit. Soaking the butt of the pole brings the point of failure very close to the load (ground) line, but complicates the study of the effect of moisture content on the strength.

The small clear static-bending tests serve to check the values of modulus of rupture found from the pole tests; they show that the high values were not due to low moisture content or to variations in the sectional moisture content of the pole but to the strength of the wood itself; they indicate the effect of defects on the pole. All the small tests show material of a higher specific gravity than that from old-growth western cedar. They confirm the fact that higher strength values are obtained from pole-size trees than from mature timber.

Report on tests of the relative strength of green-cut and fire-killed western cedar pole timber, T. A. McElhanney and R. S. Perry (*Canada Dept. Int., Forest Serv. Circ. 22 (1928), pp. 15, fig. 1*).—The results of tests on western cedar poles, both green-cut and fire-killed, and on small clear test specimens cut from them after breaking are reported.

Soaking the butt brought the fracture to the load (ground) line in nearly every test, closely simulating service conditions. The number, extent, and location of defects has a noticeable effect on the strength of the pole as a unit.

The small clear static-bending tests showed that the high values obtained in the pole tests are due to the inherent strength of the wood and indicate the effect of defects in the pole. All small tests show a higher specific gravity than tests from mature western cedar. They confirm the opinion that higher strength values are obtained from pole-size trees than from mature trees of this species.

The tests also showed that the strength of fire-killed poles is not materially lower than that of green-cut poles, that there is no difference in the strength of the wood from green and from fire-killed poles, and that the fire-killed pole, as a unit, is of practically the same strength as the green.

Tests on the hardness of the sapwood of all poles showed no variation in sapwood hardness for poles, whether green-cut or fire-killed, and the variation in moisture content of the sapwood was very small.

Report on the absorption of moisture by kiln-dried lumber, J. H. Jenkins (*Canada Dept. Int., Forest Serv. Circ. 23 (1928), pp. 15, figs. 5*).—Studies are reported which indicate that the absorption of moisture in kiln-dried lumber in storage is an important problem. Rapid absorption occurs until the moisture content is at equilibrium with the atmospheric conditions. This increase in moisture content results in a corresponding increase in the size and the shipping weight of the stored stock. In cases where seasoned lumber is stored for several months during the winter, there is a danger of the increase in moisture content due to absorption being sufficient to cause checking when the lumber is eventually placed in service in the interior of a heated building. The studies show that there is a very appreciable difference between the absorption of moisture by lumber stored in a tight, heated shed and that stored in an open shed during the seasons of high humidity and low temperatures.

Suitability of little-used species of wood for shipping containers, T. A. Carlson (*Amer. Lumberman, No. 2810 (1929), pp. 38–40, figs. 4*).—Tests conducted by the U. S. D. A. Forest Products Laboratory with several species of wood for use in shipping containers under different conditions are reported.

The results showed that green boxes lost five-sixths of their resistance to rough handling after drying for about 60 days under conditions similar to a moderately dry, heated warehouse.

The boxes made of air-dry lumber and stored for about 60 days under conditions which caused but little change in moisture content retained 84 per cent of their resistance to rough handling. Air-dry boxes stored for the same length of time under the conditions of an extremely dry, heated room lost more than 9 per cent moisture and retained only 35 per cent of their original strength. Similarly treated boxes, however, when again put in moderate storage regained strength until at the original moisture content they withstood 75 per cent of the rough handling of freshly nailed boxes. The indications are that boxes made of green lumber and allowed to dry will show only about one-quarter to one-half as much resistance to rough handling as boxes made of dry lumber and stored under the same conditions.

On the basis of the relative number of drops which the boxes withstood in the drum test, lodgepole pine, western yellow pine, and aspen could be grouped as giving the best results. Next in order would come California red fir, then western larch, and finally a group consisting of white fir, silver fir, western hemlock, and lowland white fir.

It was also found that a general classification of the failures in the boxes made from different species of lumber could be made which corresponded with that based on the relative resistance to tumbling in the drum.

Tests of boxes nailed with barbed nails were slightly in favor of the use of barbed nails in boxes made of dry wood and stored. The chief advantage of the barbed over the plain nail was found in the boxes made of relatively green lumber and stored under conditions favorable to drying.

The strength of reinforced and unreinforced butter and cheese boxes, G. H. Rochester (*Canada Dept. Int., Forest Serv. Circ. 24* (1929), *pp. 8, figs. 6*).—The results are reported of two investigations on the comparative serviceability of butter and cheese boxes of different types of construction, reinforced and unreinforced, for export shipments. The various types of boxes were submitted to tests in a hazard machine consisting of a revolving drum, 17 ft. in diameter, with interior floors arranged in hexagonal form. As the drum slowly revolves the box is dropped from floor to floor, and guides are so arranged as to cause it to fall successively on corners, edges, and sides, simulating in a comparatively short time the various stresses encountered in actual transportation.

The results indicated that of the 46 butter boxes of three types tested the Ontario box of dovetail design is the strongest of the types tested without reinforcements. The box with 2 parallel straps 0.5 by 0.018 in., and the one with 2 parallel wires, 13-gauge, are respectively, 5 and 3 times as strong as those without reinforcement.

The lighter strapping ⅜ by 0.015 in. when applied 2 parallel or 2 at right angles does not give as strong reinforcement as the 13-gauge wire similarly applied, but still gives double the strength of the unreinforced box. The 2 parallel wires or 2 wires at right angles apparently impart reinforcement of equal value, as far as first failure is concerned, but, under continued abuse, wiring at right angles holds the box together better than parallel wiring. The same is true for strapping.

One strap or one wire applied around the center of the box gives nearly double the strength of the unreinforced container. The use of reinforcement of one wire, 13-gauge, or one strap, preferably 0.5 by 0.018 in., applied around the center of the box over sides, top, and bottom, should prove sufficient to increase the serviceability of any of the 3 types of butter boxes tested.

The results indicated that of the 112 cheese boxes tested unreinforced standard Canadian cylindrical cheese boxes are not of sufficient strength to protect their contents adequately when subjected to severe handling. This is for the most part due to the failure of fastenings to hold the cover securely to the box and the headings to the bands.

Reinforcement by one 13-gauge annealed wire increases the serviceability of the cheese box 5 times; one ⅜ by 0.018 in. unannealed strap, 4 times; and two 13-gauge annealed wires at right angles and two ⅜ by 0.015 in. unannealed straps at right angles, 7 times that of the unreinforced box. One wire apparently strengthens the box somewhat better than one strap. This is explained by the fact that the wire, when tightened, cuts into the edges of the box and retains its position when subjected to rough handling. The strap, on the other hand, has a tendency to slip and so lose some of its effect in holding together the various parts of the box.

The reinforcement of 2 wires or 2 straps does not give the box double the strength of the single reinforcement. Either one 13-gauge annealed wire or one ⅜ by 0.018 in. unannealed strap applied around the cheese box at right angles to the direction of the pieces in the headings will give sufficient reinforcement to insure a minimum of breakage on export shipments.

The body hoop is of sufficient strength, as practically no failures occurred in that section of the box. In all the top and bottom heading and band failures the heads of the nails have invariably pulled through the veneer. The use of nails with larger heads might prevent a considerable percentage of failures of this type.

The cover of the box should be so placed that the overlaps of the body hoop and the bands may be held by a single reinforcement. Boxes constructed so that the overlaps of the bands and body hoops can be nailed into the edge grain of the headings are stronger than those where the overlap is nailed into the end grain. Where single reinforcement is used with the above type of box, the cover should be fitted so that the pieces in the top and bottom headings run in parallel directions and the overlaps of hands and body hoops are in line. Single reinforcement should then be placed at right angles to the direction of the heading pieces, and across the overlaps.

Cement concrete posts for fencing, W. J. Spafford (*Jour. Dept. Agr. So. Aust., 32 (1929), No. 7, pp. 612–623, figs. 8*).—Information is given on the design and manufacture of cement concrete fence posts, together with working drawings of forms, wire attachments, and methods of reinforcing.

Air infiltration through various types of brick wall construction, G. L. Larson, C. Braatz, and D. W. Nelson (*Jour. Amer. Soc. Heating and Ventilating Engin., 35 (1929), No. 3, pp. 125–136, figs. 6*).—The results are reported of a study by the University of Wisconsin and the American Society of Heating and Ventilating Engineers which dealt with five 13-in. brick walls of different character as regards nature of brick, mortar, and workmanship.

The test apparatus consists essentially of a pressure chamber and collecting chamber, between which the test wall is secured, and air-tight seals are made between the two sides of the wall. Artificial wind pressure is produced by a small motor-driven blower, communicating with the pressure chamber through an adjustable damper which controls the pressure drop through the wall.

Two types of brick were used, one hard face and the other more porous, and three walls were built with cement-lime mortar and the other two with lime mortar. Each wall was subjected to a wind pressure corresponding to a range of wind velocities of from 5 to 30 miles per hour.

The results apparently revealed no correlation between the amount of infiltration and the aging of the test walls or between the humidity at the time of the tests and the variation in infiltration.

A greater variation in infiltration was observed between the good and the poor walls built of porous brick than between those built of hard brick. The conclusion is drawn that the same grade of workmanship results in more leakage through cement-lime mortar joints on porous brick than on hard brick. "This would indicate then that to secure the same infiltration through mortar in a porous brick wall as in a hard brick wall additional care in workmanship would be required to the extent of soaking the bricks before laying."

Fire resistance of hollow load-bearing wall tile, S. H. INGBERG and H. D. FOSTER ([U. S.] *Bur. Standards Jour. Research, 2 (1929), No. 1, pp. 334, pls. 41, figs. 146*).—The results of three series of fire tests of wall construction built of hollow load-bearing wall tile of representative designs and clay materials are reported.

The first tests were made on wall sections 1 ft. wide and 6 ft. high that were subjected to fire on one side while under working load, the main object being to determine how the fire exposure affects the individual tile units. This was found to vary with the type of clay used, hardness of burning, and design of the unit, from minor cracking of a few of the units in the specimen to failure under load a little after two hours.

The second group of tests was with wall specimens 4 ft. wide and 4 ft. high exposed to fire on one side, under load or restrained within the containing frames, and was made to study the effect of changes in design of the unit and in the constituents and preparation of the clay.

The addition up to 2 per cent of ground burned clay to the raw clay was found to be without effect, but higher percentages increased the fire damage, apparently because of initial shrinkage cracks radiating from the grog particles. Additions up to 15 per cent by volume of sawdust to the raw clay decreased the tendency to cracking when exposed to fire without seriously decreasing the normal strength of the tile. Finer grinding and a greater amount of pugging of the raw clay increased the strength of the tile and consequently its load-carrying ability when exposed to fire.

Of modifications in the design of the unit, one with double outside shells improved the fire resistance for all but very dense tile in confining the cracking mainly to an outer thin shell. Increased shell thickness was found to decrease the fire effects, as also fillets of up to ¼ in. radius at the junctions of shells and webs.

The final series consisted of 167 fire-endurance tests and four fire and water tests of typical wall constructions, 71 of which were made with walls between 10 and 11 ft. high and 8 to 16 ft. wide. The thickness ranged from 8 to 16 in., and plaster, stucco, or brick facing was applied on a number of the walls. The walls were subjected to constant applied loads of 70 to 120 lbs. per square inch during the fire test, were restrained within the containing frames, or were tested unrestrained, the latter condition being representative of walls in low buildings or the upper-story walls of higher buildings. The results are summarized as fire-resistance periods, which are determined by the time the walls sustained load under fire exposure and prevented the average temperature rise on the unexposed side from exceeding 139° C. (282° F.) or the maximum rise at any point where temperature measurements are taken from exceeding 180.6° C. (357° F.).

Fire resistant construction, R. E. STRADLING and F. L. BRADY (*[Gt. Brit.] Dept. Sci. and Indus. Research, Bldg. Research, Spec. Rpt. 8 (1927), pp. VI+57, pls. 2, figs. 27*).—Part 1 of this report presents a brief outline of the effect of high temperatures upon building materials generally.

Part 2 reports experiments to elucidate and to improve the fire-resisting properties of concrete. It is shown that by the addition of a pozzolanic material to Portland cement concrete a very considerable absorption of the lime, set free on hydration of the cement, can be brought about, the presence of this free lime being demonstrated to be the most serious factor in the deterioration of concrete under fire.

The conclusion was drawn that fire-resistant cement may be made by the addition of various substances to the cement, the most suitable of these being certain varieties of clinker and baked clay. Spent shale was found to be a promising material, and granulated slag also gave excellent results.

It was found that the special cement can be used in conjunction with fine aggregates such as red brick and dolerite of different kinds.

Three appendixes on a method for determining free lime in Portland and special cements, the suitability of furnace clinker as an addition to Portland cement, and high aluminous cements are included, together with a bibliography.

Fire-protective construction on the farm (*U. S. Dept. Agr., Farmers' Bul. 1590 (1929), pp. II+22, figs. 12*).—This presents practical information on the construction of fire-risistant farm buildings, and is based on the original findings of the farm fire protection committee of the National Fire Protection Association.

Attention is drawn especially to the fire hazards generally found in farm-building construction, and suggestions are made as to how they may be avoided in new buildings or remedied in existing structures.

Paints and painting, E. W. KENDALL (*Ontario Dept. Agr. Bul. 341 (1929), pp. 29, figs. 25*).—Practical information is given on the selection, mixing, and use of paints and whitewashes on farm buildings and on estimating the amounts required.

The continuous can washer for dairy plants, A. W. FARRALL (*California Sta. Bul. 466 (1929), pp. 31, figs. 16*).—The results of an investigation are reported which indicate that there is room for improvement in the care and operation of the average can washer. The proper cycle for can washing appears to be draining, rinsing, washing, steaming, and drying. Efficiency in washing is maintained by keeping all jets and tanks clean and all solutions at the proper temperature. The can temperature follows the temperature of the jet very closely.

Wet or saturated steam is satisfactory for heating cans and giving them the first steam treatment. Dry and preferably superheated steam should follow the wet steam treatment. The attachment of a superheater may improve the drying powers of a can washer. High-pressure steam is desirable for can washers in order to obtain high temperatures. The temperature is practically the same in all parts of the can when it is steamed over a high-pressure jet.

Drying of cans requires high-temperature air taken from a dry source. Smooth cans are easily dried and rendered sterile, whereas those containing rough seams are not. There is a real need for a good seamless can. The can lids are difficult to dry and wash; a dome type lid showed good results from the drying standpoint. Moisture is often splashed into dry cans by jets not properly separated from the drying compartment. Hot cans will dry out very well if they are allowed to stand uncovered for a few minutes in an inverted position.

The power consumed by washers operated entirely by steam was from 43 to 72 h. p. at capacities ranging from 360 to 600 cans per hour. The steam consumed per can by the steam-operated washers ranged from 4.58 to 5.59 lbs. The steam consumed per can by the combination steam and electric washer ranged from 1.84 to 3.64 lbs. The electricity consumed by the washers varied from 0.84 to 2.36 kw. hours per hundred cans for those with motor-driven pumps; others required from 0.045 to 0.271 kw. hour. The water requirements varied from 0.85 to 4.07 gal. per can washed. The power used per can is greatly increased by operating at partial capacity.

The Dunbar sewage filter, E. W. STEEL and P. J. A. ZELLER (*Tex. Engin. Expt. Sta. Bul. 37 (1928), pp. 15, figs. 3*).—Studies to determine the efficiency of the Dunbar sewage filter under Texas conditions are reported. The experimental bed consisted of 16 in. of comparatively fine material supported by several layers of graded aggregate, the whole resting on a layer of rather large material.

The results showed that at rates of operation up to 2,000,000 gal. per acre per day, an 85 per cent reduction in the biochemical oxygen demand may be expected. Operation at the rate of 1,300,000 gal. per acre per day proved to be the optimum rate, and is the highest rate at which it is possible to secure good nitrification of the effluent and high dissolved oxygen in the effluent. Operation at a rate above the optimum and up to 2,000,000 gal. per acre per day will produce a clear effluent, satisfactory for many purposes, but nitrification will be incomplete and dissolved oxygen will not be present.

Clogging of the bed may be expected after the application of 8,000,000 gal. of settled sewage per acre of bed surface. Prolonged resting of the bed between doses is unnecessary, although it apparently does no harm. Resting is necessary only to allow drying and removal of the solids caught upon the surface of the bed.

RURAL ECONOMICS AND SOCIOLOGY

[Proceedings] of the annual meeting of the New England Research Council (*[Boston: New England Research Council, 1928], pp. [78]*).—Included are mimeographed copies of the following papers presented at Boston, December 6 and 7, 1928: A Plan for Improving the Agricultural Outlook, by A. W Manchester (pp. 2); Commodity Studies, by H. R. Tolley (pp. 2); Economic Research in the Tobacco Industry of New England, by I. G. Davis (pp. 6) Economic Research in the Poultry and Egg Industry, by H. W. Yount, (pp. 5) Economic Research in the Apple Industry of New England, by C. H. Merchar (pp. 8); Research in Agricultural Land Utilization, by J. D. Black (pp. 10) Definition of the Field of Land Utilization in New England, by I. G. Dav (pp. 7); The Vermont Rural Life Survey, by H. C. Taylor (pp. 3); Lar Utilization Studies in Vermont, by H. P. Young (pp. 2); Studies of Soil Ty as it Affects Farm Economy, by C. I. Hendrickson (p. 1); Research in Pa time Farming, by D. Rozman (pp. 2); Community Studies, by H. C. Woo worth (pp. 3); The American Geographical Society's Studies of the Populati of New England, by J. K. Wright (pp. 5); Research in Forestry in New Er land that Relates to Agricultural Land Utilization, by H. H. Chapman (pp. 5 Prospects for Utilization of Land for Timber in New England, by R. T. Fis (p. 1); Program of Research in Land Utilization, by A. E. Cance (pp. 8 and Opportunities for Cooperation in Local Land Utilization Studies, by L. Gray (pp. 9).

[Investigations in agricultural economics at the New Mexico Stati 1927–28] (*New Mexico Sta. Rpt. 1928, pp. 63–67*).—Results of investigati ... reported as follows:

The economics of sheep production in New Mexico.—Detailed records for 1927 from 10 ranches showed the following averages: Number of sheep, January 1, 1927, 2,770; investment per ranch $43,039, of which 65 per cent was in sheep, 32 per cent in real estate, and 3 per cent in other livestock and equipment; receipts per ranch (9 ranches) $16,400, of which 88 per cent was cash and 12 per cent was increase in value of sheep; and expenses per ranch $11,056, of which 96 per cent were cash expenses. Of the cash receipts 61 per cent were from sales of sheep and lambs, 26 per cent from wool sales, and 1 per cent from pelts and miscellaneous items. The rate of capital turnover averaged approximately 47 per cent.

[*Returns on capital investment on owner-operated farms*].—A study covering the years 1924–1927 and including from 69 to 97 farms in Roosevelt County and from 68 to 98 farms in Curry County showed that the average percentages earned on investment for the different years varied from —2.6 to 7.2, averaging 3.5 per cent, for the Roosevelt County farms; and from —3.9 to 10.8, averaging 4 per cent, for the years 1924–1926, for the Curry County farms. The averages for the 20 highest farms varied from 6 to 14.3 per cent, averaging 11.2 per cent, for Roosevelt County, and from 4.1 to 26.5 per cent, averaging 16.6 per cent, for Curry County farms.

[*Factors affecting the value of eggs for storage*].—The following approximate differences in the value of eggs per case for storage purposes were found in the experiments noted on p. 261: Eggs from cottonseed meal fed flocks $2.64 less than those from no cottonseed meal fed flocks, eggs 11 days old or more $1.81 less than eggs 5 days old or less, eggs from flocks having access to all the green feed desired $1.06 less than eggs from flocks having no green feed or only limited amounts, eggs stored in a warm place prior to shipping 63 cts. less than those stored in a cool place, fertile eggs 61 cts. less than infertile eggs, and eggs from farm flocks $1.26 less than eggs from commercial poultry farms.

It was found that eggs stored during March and April and sold at the end of a 6-month storage period were preferable to those stored in February and May, and that the distance eggs were shipped from New Mexico points to El Paso, Tex., did not impair the quality nor affect the sale price.

Farm relief, edited by C. L. KING (*Ann. Amer. Acad. Polit. and Social Sci., 142 (1929), No. 231, pp. VIII+1–453, 466–479, figs. 54*).—Articles on different phases of farm relief are included as follows:

Part I. *Some facts*.—Recent Trends in Real Farm Income, by L. H. Bean (pp. 1–6); The Farm Income Problem, by R. J. McFall (pp. 7–15); The Recent Trend in the Purchasing Power of Farm Products, by A. B. Genung (pp. 16–19); The Trend in the Farm Ownership, by L. C. Gray (pp. 20–26); Trends in Farm Land Values in the United States from 1912 to 1928, by K. Scholz (pp. 27–43); Population Trends, by J. M. McKee (pp. 44–50); Movements to and from Farms, by C. L. Stewart (pp. 51–57); Tendencies in Milk Production in Massachusetts: A Study in Land Utilization, by R. J. McFall and R. E. Sherburne (pp. 58–69); and Forestry and the Agricultural Crisis, by R. Zon (pp. 70–76).

Part II. *Some causes*.—Recent Trends in Export Trade in Agricultural Products, by E. G. Montgomery (pp. 77–79); Trends in Agricultural Exports, by H. R. Enslow (pp. 80–88); Tariff Handicaps, by J. E. Boyle (pp. 89–96); Changes in Production and Consumption of Our Farm Products and the Trend in Population: Do We Need More Farm Land? by O. E. Baker (pp. 97–146); Transportation Rates and Facilities, by H. Gabriel (pp. 147–150); The Public Lands and Immigration, by D. Young and W. W. Weaver (pp. 151–157); Stabilization of Prices and the Farmer's Income: The Need for Control of the Farm Supply, by J. S. Lawrence (pp. 158–169); The Increased Cost of Erosion,

by H. H. Bennett (pp. 170–176); Reclamation Projects and Their Relation to Agricultural Depression, by M. Peck (pp. 177–185); The Futility of Further Development of Irrigation Projects, by F. P. Willits (pp. 186–195); and Relief from Farm Labor Costs, by J. C. Folsom (pp. 196–201).

Part III. *Some economic remedies.*—Science and the Farmer, by F. D. Farrell (pp. 202–209); Recent Trends Balancing Agriculture in the United States, by W. J. Spillman (pp. 210–215); Diversification of Agriculture—Its Limitations and Its Advantages, by W. E. Grimes (pp. 216–221); Livestock Prices Bring Farm Relief, by S. W. Russell (pp. 222–227); The Industrialization of Agriculture, by F. App (pp. 228–234); Agricultural Contrasts, by L. W. Wallace (pp. 235–244); Outlook for the Dairy Industry in the United States, by A. F. Woods (pp. 245–249); What the Agricultural Extension Service Has Done for Agriculture, by M. S. McDowell (pp. 250–256); The Economic Significance of Commercial Fertilizers, by J. G. Lipman (pp. 257–265); Farm Products in Industry, by G. M. Rommel (pp. 266–270); Farm Relief and a Permanent Agriculture, by R. G. Tugwell (pp. 271–282); The Mississippi Waterway, by N. F. Titus (pp. 283–290); The St. Lawrence Waterway, by G. P. Pillsbury (pp. 291–295); Recent Migrations of Industries in the United States, by R. H. Lansburgh (pp. 296–301); The Outlook for Crop Insurance, by G. W. Hoffman (pp. 302–311); and the General Property Tax as a Factor in the Unsatisfactory Agricultural Situation, by F. P. Weaver (pp. 312–317).

Part IV. *Some marketing remedies.*—Some Essentials of a Farm Relief Plan, by A. Capper (pp. 318–321); The Essentials in Farm Relief as Viewed by the American Farm Bureau Federation, by S. H. Thompson (pp. 322–328); The Attitude of the National Grange toward the Tariff, by L. J. Taber (pp. 329–333); Limitations, Advantages, and Special Field of Direct Marketing, by G. S. Watts (pp. 334–340); Market Information and the Farmer's Problems, by F. F. Lininger (pp. 341–351); A Foreign Policy for the American Farmer, by J. G. Hervey (pp. 352–357); Agricultural Aid in Czechoslovakia, by A. Prokes (pp. 358–360); Aid to German Agriculture, by R. E. Bose (pp. 361–366); Some National Policies toward Agriculture, by C. L. Stewart (pp. 367–379); Plans for Raising Prices of Farm Products by Government Action, by J. D. Black (pp. 380–390); The Relation of Annual Weather Surpluses to Net Farm Incomes, by G. M. Peterson (pp. 391–401); Stabilization of Farm Prices and the McNary-Haugen Bill, by H. A. Wallace (pp. 402–405); A Half Century of Cooperative Marketing in the United States and Canada, by J. F. Booth (pp. 406–413); Recent Trends in Cooperative Marketing, by B. H. Hibbard (pp. 414–418); Standardizing Production—What Has Been Done and What Can Be Done, by W. A. Sherman (pp. 419–424); The Standardization Program of the Agricultural Cooperatives of the United States, by R. W. Balderston (pp. 425–438); What a Federal Farm Board Can Do—A Basis for a National Agricultural Policy, by C. L. King (pp. 439–447); The Pending Federal Farm Board Bill, by C. L. McNary (pp. 448, 449); Agriculture Surplus Control, by W. M. Jardine (pp. 450–458); and Operation of the Australian Diary Produce Export Board, by J. R. King (pp. 466–468).

Report of conference on research institute on rural affairs, K. L. Butterfield et al. (*New York: Columbia Univ., 1928, pp. 18*).—This is the report of the conference called by the president of Columbia University to consider the practicability of organizing a research institute on rural affairs. A plan for such an institute in Columbia University is outlined.

Land economics, R. T. Ely and G. S. Wehrwein (*Ann Arbor, Mich. Edwards Bros., 1928, pp. [3]+221*).—This is part 1 (mimeographed) of a text book, and sets forth the basic facts about land, its physical properties and characteristics in so far as they influence human relationships, under the fo

lowing headings: The field of land economics and the classification of land, property in land economics, characteristics of landed property, the utilization of land, agricultural land, the utilization of the arid lands, forest resources—the cut-over land, recreational land, water resources, mineral resources, urban land, and population and land.

Farm tenancy and lease forms in Pennsylvania, J. E. McCord (*Pennsylvania Sta. Bul. 232 (1929), pp. 48, figs. 2*).—This bulletin includes a general presentation of the development and present-day problems of tenancy, especially in Pennsylvania; a statistical analysis of data obtained regarding 309 tenant farms in 26 counties of Pennsylvania, with a discussion of the factors and conditions which have necessitated changes in relations between landlords and tenants; and lease forms and suggestions for preparing contracts.

On the 309 farms, 76.7 per cent were operated by share tenants and 23.3 per cent by cash tenants. Of the contracts, 52.3 per cent were oral and 47.7 per cent were written. Tables are included showing (1) for the different sections of the State the types of contracts; and (2) by types of contracts the length of lease; provisions as to termination, rights in winter grain at termination, and payment of taxes and expenses for fertilizer, spray material, seed, and threshing; and restrictions on tenants.

Other tables show by sections of the State (1) for landlords, the number reared on farms, length of ownership, how farms were acquired, number of years farm has been operated by tenants, steps in acquiring ownership, age, size of families, education, and number of farms owned; and (2) for tenants, the length of tenure on present farms, education, relationship to landlord, size of families, experience, percentage intending to buy farms, number keeping accounts, the cash rental paid, and the value of land and equipment of cash-rented farm.

A local farm real estate price index, F. M. Thrun (*Michigan Sta. Tech. Bul. 96 (1929), pp. 31, figs. 4*).—The author has computed a price index for farm real estate in Ingham County, Mich., for the period from 1890 to 1925, inclusive. Some 700 farms, representing 48,838 acres, form the basis for the index. The total number of sales and the total acreage included in the index were 1,648 and 113,639, respectively. The number of sales and the acreage of sales for the individual years varied from 8 to 83 sales and from 401 to 5,966 acres.

In combining the sales data into an index, the price relatives—the percentage that later sales prices of a piece of property were of the first sale price—were computed. The arithmetical average of the relatives having a common base were then computed for each year. Each average of relatives was transformed into link-relative on the basis of the average link-relatives already computed. To express each preceding year as a percentage of the base year, the link-relatives were chained together "by dividing the base year, which was given a value of 100, by the link-relative of that year. This gave the value of the year preceding the base year. This value, in turn, was divided by the link-relative of the year, and the resulting quotient then divided by the next link-relative." For the years following the base year, the values were multiplied instead of divided. A table is given showing the link-relatives and chained index for each year from 1890 to 1925, inclusive, using the year 1913 as the base year.

Graphs are included showing the real estate index by years, and comparisons between this index and the per acre crop value index for Michigan and the all commodity wholesale price index of the U. S. Bureau of Labor Statistics. Another table shows the Bureau of Labor Statistics all commodity wholesale price index, and the farm real estate price index and the per acre crop value

ndex, each divided by the Bureau of Labor Statistics price index. A comparison of these "deflated" real estate price and crop value indexes is shown by graph.

The undeflated real estate index (1913=100) showed changes with small fluctuations as follows: Increases from 54.9 in 1890 to 61.3 in 1895, decrease to 50.8 in 1897, increase to 105 in 1914, decrease to 96.6 in 1915, increase to 142.1 in 1920, and decrease to 115.1 in 1925. The "deflated" real estate price index showed changes with minor fluctuations as follows: Increase from 68.2 in 1890 to 87.5 in 1895, decrease to 69.7 in 1899, increase to 77.2 in 1904, decrease to 73.7 in 1907, increase to 107 in 1914, decrease to 59.7, 63.2, and 62.8 in 1918, 1919, and 1920, respectively, increase to 93.3 in 1921, and decrease to 72.5 in 1925. The deflated series for farm real estate prices and per acre crop values indicate the dependence of real estate prices on the purchasing power of crop yields, the real estate prices seeming to lag to some extent, but much less so in the later years than in the earlier years.

A brief review of rural credit facilities in New Zealand, T. D. Hall (*Econ. Rec., 4 (1928), No. 7, pp. 260–269*).—A summary is given of the existing credit facilities afforded by private sources and under the Government Advances to Settlers Act, 1894; the Rural Advances Act, 1926; and the Rural Intermediate Credit Act, 1927; and of the recommendations of the Commission of Inquiry into Rural Credit appointed in 1925.

State systems of taxation for public schools, II, III, F. H. Swift (*Amer. School Bd. Jour., 78 (1929), Nos. 4, pp. 45, 46; 5, pp. 65, 66, 150, 152*).—These are the second and third of the series of articles previously noted (E. S. R., 60, p. 887).

II. The North Carolina plan.—North Carolina at present levies no State tax specifically for schools. State appropriations for schools are made from the general fund, which is raised chiefly from income, inheritance, corporation, and business-license taxes and departmental and miscellaneous fees. The State also has two funds, neither derived from State taxes, from which loans are made to counties for building school buildings.

III. The Connecticut plan.—In 1925–26 Connecticut expended 7.3 per cent of its State general fund in appropriations for public elementary and secondary schools. None of its various State taxes are levied specifically for the benefit of schools.

Transportation charges in the United States and Canada, C. S. Duncan and E. F. Bilo (*Washington, D. C.: Assoc. Ry. Exec., 1928, pp. 49, pls. 2*).—This report, prepared for the Association of Railway Executives, was the result of a survey of the production, transportation, and marketing of grain in the United States and Canada, with special reference to the export trade. The production, domestic consumption, and movement of grain in, and the exports from, the United States and Canada; the diversion of United States grain through Canadian ports; the rail and water rates, grading and inspection, port facilities, service, and charges in, and the ocean rates from, the two countries; and the preferential customs regulations in each country are discussed.

The basis of Canadian railroad rates for wheat and the Canadian governmental policy as regards rates are described and compared with conditions in the United States.

An economic study of retail feed stores in New York State, E. A. Perregaux (*New York Cornell Sta. Bul. 471 (1928), pp. 61, figs. 11*).—The bulletin is based upon data regarding sales, margins, operating expenses, financial organization, and other phases of business obtained by personal visits during 1925 to 20 cooperative stores and 50 stores operated by private dealers. Detailed reports of the business operations for the year 1924 were obtained from

14 cooperatives and 33 private dealers. The data are analyzed and discussed under the headings of management and labor, capital, land and buildings, equipment, sales, margins, operating expenses, net operating income, factors affecting sales, margins, expenses, and income, and credit.

For the 14 cooperatives and 33 private dealers the average gross margins were 10.29 and 12.24 per cent, respectively, and expenses 9.26 and 11.21 per cent, respectively, of net sales. The net operating incomes were 1.03 and 1.02 per cent, respectively, of net sales. Salaries and wages, land, building, and equipment costs, bad debts, and interest amounted to 3.95, 1.06, 1.02, and 2.24 per cent, respectively, of net sales for the cooperatives, and 5.4, 1.14, 0.77, and 2.35 per cent, respectively, for the private dealers. The rate of return on capital for the 47 stores varied from a loss of 19.9 per cent to a gain of 31.7 per cent, averaging 8.7 per cent. The return on net worth for 43 stores varied from a loss of 49.2 per cent to a gain of 100.8 per cent, averaging 13.9 per cent.

Of the stores doing grinding, most of those having sales of $100,000 or less failed to pay expenses. Of those not doing grinding, most of those with sales of less than $60,000 lost money. Outstanding accounts and notes constituted 36 and 44 per cent, respectively, of the capital of the cooperative and of the private dealers. Credit was extended on 62 per cent of cooperative store sales and on 75 per cent of private store sales. The number of days credits were on the books averaged 58 and 75, respectively. Of the book accounts 49.9 per cent were collected within 30 days and 34.8 per cent between 31 days and 6 months.

Copies of the blanks used in the study are included.

The marketing of Michigan milk through creameries, cream stations, condenseries, and cheese factories, F. T. Riddell and J. T. Horner (*Michigan Sta. Spec. Bul. 189* (*1929*), *pp. 36, figs. 11*).—This bulletin is based chiefly upon data for the years 1924 and 1925 secured from 192 plants. Tables are given and discussed showing for plants of different sizes and different kinds the amount of butterfat received, the sources from which received, the cost of hauling for different distances, and the average prices paid by months, 1924 and 1925, to farmers for whole milk by condenseries, cheese factories, and the Detroit city fluid milk market. The methods and costs of marketing milk for different purposes are described and discussed.

The status of the dairy industry in Michigan, price trends of butter in New York City, imports and exports, 1909–1926, of dairy products, and the effects of cold storage on butter prices are discussed.

Agricultural regions of North America.—Part VII, The Middle Atlantic trucking region, O. E. Baker (*Econ. Geogr., 5* (*1929*), *No. 1, pp. 36–69, figs. 29*).—This is the seventh article of the series previously noted (E. S. R., 60, p. 382).

Enterprise efficiency studies on California farms.—A progress report, L. W. Fluharty and F. R. Wilcox (*Calif. Agr. Col. Ext. Circ. 24* (*1929*), *pp. 79*).—This is a progress report based upon 5 studies completed in 1925, 20 in 1926, and 49 in 1927. Records were obtained from 1,713 farmers in 28 counties, and 22 different farm commodities are covered.

Included are tables showing the average cost by items; income and net profit per acre, cow, hen, or bird, and per ton, box, pound, hundredweight, pound of butterfat, dozen eggs, or pound of meat; and general information such as the number of records, total number of acres, cows, hens, etc., in the study, and the total production, average highest and lowest yields, and cost per unit of highest and lowest yields for apples, apricots, and walnuts in 3 counties, peaches and pears in 2 counties, dairying in 5 counties, hens and eggs in 14 counties, prunes, grapefruit, lemons, oranges, alfalfa, beans, cotton, potatoes, wheat, summer fallow for grain, and turkeys in 1 county each, and Thompson grapes

old all dried, fresh and dried, and all fresh in 1 county, Muscat grapes, sold ill dried, fresh and dried, and all fresh in 1 county, and Malaga, Emperor, Cornichon, juice, Tokay, and raisin grapes in 1 county each.

Representative examples of summaries used in presenting the cost and efficiency data to the cooperators are shown for apples, oranges, walnuts, dairying, and poultry.

The agricultural output of Scotland, 1925, J. M. RAMSAY (*Edinburgh: Bd. Agr. Scotland, 1928, pp. 94*).—This is the report on the census of agricultural production in Scotland, taken in 1925. It deals with the total area of land used for agricultural purposes and the changes in distribution since 1871; the production of different crops; the changes in the numbers of livestock since 1871; the distribution of land and livestock in 1913 and 1925; the output of different livestock products, 1925; the assessed valuation of products; the number and size of holdings; the number of persons employed in agriculture and the distribution by sex, areas, and occupation; and motive power on farms.

The influence of the war upon agricultural production in Germany, F. AEREBOE (*Der Einfluss des Krieges auf die Landwirtschaftliche Produktion in Deutschland. Stuttgart: Deutsche Verlags-Anstalt; New Haven: Yale Univ. Press, 1927, pp. XV+233*).—This volume is one of the German series on the Economic and Social History of the World War of the Carnegie Endowment for International Peace. The development of agriculture in Germany prior to the World War and the conditions and changes during and since the war are described.

The world wheat situation, 1927–28: A review of the crop year, M. K. BENNETT ET AL. (*Wheat Studies, Food Research Inst. [Stanford Univ.], 5 (1928), No. 2, pp. [1]+45–112, figs. 11*).—This is the fifth of the series previously noted (E. S. R., 59, p. 485) and reviews for the crop year 1927–28 the supply position, consumption, stocks and carry-overs, wheat price movements, international trade, and the year in milling.

Survey of the wheat situation, August to November, 1928, M. K. BENNETT ET AL. (*Wheat Studies, Food Research Inst. [Stanford Univ.], 5 (1929), No. 3, pp. [1]+113–146, figs. 5*).—This is a continuation of the survey previously noted (E. S. R., 60, p. 590). It covers developments, marketing and stocks, international trade, wheat price movements, and the international position and outlook.

International yearbook of agricultural legislation [trans. title] (*Inst. Internatl. Agr. [Rome], Ann. Internatl. Lég. Agr., 17 (1927), pp. LXXI+354*).—This volume continues the series previously noted (E. S. R., 59, p. 482), but omits the chronological list of laws, decrees, and regulations, and does not give the full text of the laws. The English edition of the yearbook has been suspended.

International yearbook of agricultural statistics, 1927–28 (*Internatl. Inst. Agr. [Rome], Internatl. Yearbook Agr. Statis., 1927–28, pp. XXXII+557*).—This is a continuation of the series previously noted (E. S. R., 58, p. 188). The table of contents, index, introduction (pp. IX–XXXII), and general notes (pp. 543–548) are in English only. The tables are in French and English.

Nebraska agricultural statistics, 1927, compiled by A. E. ANDERSON and W. H. FORSYTH (*Lincoln: Nebr. Dept. Agr., [1928], pp. 224, figs. 67*).—A joint report of the State Department of Agriculture and the Bureau of Agricultural Economics, U. S. D. A.

Crop and livestock report, 1927 (*Penn. Dept. Agr. Bul. 465 (1928), pp. 69*).—Crop and livestock statistics for Pennsylvania for 1927, collected and compiled by the Pennsylvania Department of Agriculture and the Bureau of Agricultural Economics, U. S. D. A., are reported.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

The development of the teaching of agriculture in Mississippi, R. J. SLAY (*New York: Bur. Pubs., Teachers Col., Columbia Univ., 1928, pp. VIII+194, figs. 6*).—In this thesis, submitted to the faculty of philosophy of Columbia University in partial fulfillment of the requirements for the degree of doctor of philosophy, the historical, legal, and early experimental background of the study is presented. The development of the Mississippi Agricultural and Mechanical College, the State experiment station, the agricltural extension work, the teaching of agriculture in the elementary schools, agricultural high schools, and vocational education in agriculture is traced up to 1920 and 1925. The developments and advances made since 1920 in the teaching of agriculture in the college, State normal schools, elementary schools, county agriculutral high schools, and Smith-Hughes schools, together with some of the results and recent tendencies, are considered critically, and recommendations are made for reorganizing and strengthening the teaching of agriculture in the State.

Southern field-crop enterprises, edited by K. C. DAVIS (*Philadelphia and London: J. B. Lippincott Co., 1928, pp. IX+550, figs. 273*).—This textbook follows the job analysis plan of organizing the subject matter and covers the following enterprises: Cotton, corn. small-grain, sorghum, grass, clover, alfalfa, peanut, soybean and cowpea, annual legume, potato, sweetpotato, tobacco, rice, sugarcane, asparagus, salad-crop and cole-crop, root-crop and bulb-crop, bean, melon, and tomato, eggplant, and pepper. The following collaborators prepared the text on one or more enterprises: E. R. Alexander, D. M. Clements, E. B. Matthew, E. B. Neims, Z. M. Smith, R. I. Throckmorton, W. S. Newman, J. K. Coggin, W. H. Garrison, F. G. Burd, J. G. Lee, jr., and E. W. Garris.

Horticulture enterprises, edited by K. C. DAVIS (*Philadelphia and London: J. B. Lippincott Co., 1929, pp. IX+466, figs. 257*).—This textbook follows the job analysis plan of organizing the subject matter and covers the following enterprises: Apple and pear; peach, plum, and cherry; strawberry; grape; bushfruit; tomato, eggplant, and pepper; melon, corn, bean, and okra; onion-group; beets and other garden roots; asparagus; rhubarb; celery; lettuce; cabbage and cauliflower; mustard and spinach; garden peas; woodland; and improvement. Other chapters give plans for home vegetable gardens and information regarding growing horseradish, seakale, and globe and Jerusalem-artichokes. The following collaborators prepared the text on one or more enterprises: T. J. Talbert, M. A. Blake, A. S. Colby, S. Johnston, L. M. Montgomery, V. R. Gardner, H. C. Thompson, R. S. Maddox, and W. B. Balch.

Farm machinery, A. A. STONE (*New York: John Wiley & Sons; London: Chapman & Hall, 1928, pp. XII+466, figs. 285*).—This textbook is intended primarily for schools and departments of vocational agriculture. It is prepared on the job-analysis plan and includes job units and laboratory studies covering the different kinds of farm machinery.

Workers in subjects pertaining to agriculture in State agricultural colleges and experiment stations, 1928–1929, M. A. AGNEW (*U. S. Dept. Agr., Misc. Pub. 43 (1929), pp. IV+144*).—This is the usual annual list (E. S. R., 59, p. 90).

FOODS—HUMAN NUTRITION

Nutrition laboratory, F. G. BENEDICT (*Carnegie Inst. Wash. Yearbook 27 (1927–28), pp. 153–165*).—This is the customary annual report (E. S. R., 60, p. 189), including brief accounts of the investigations in progress and abstracts

' published reports, most of which have been noted from other sources (E. S. R.,), pp. 389, 390, 391, 392, 593.)

Continuation and extension of work on vegetable proteins, T. B. OSBORNE nd L. B. MENDEL (*Carnegie Inst. Wash. Yearbook 27 (1927–28), pp. 369–375*).—ncluded in this annual report (E. S. R., 60, p. 189) is a brief account of the rogress to date in the study of the relation of rate of growth to diet.

In addition to results which have been noted from another source (E. S. R., 58, p. 592), it is stated that some of the gains recorded would correspond in the human being to a gain in weight of 24 lbs. per year. The possibility, as indicated by a recent study of the rate of growth of infants, that the mineral ingredients in human milk may not represent an optimum mixture has led to a study of the effect upon the growth of rats of increasing the proportion of salt mixture in one of the feeding mixtures with which rapid gains of growth had been made. With 2.5, 5, and 10 per cent of the diet furnished by the Osborne-Mendel salt mixture growth was rapid, but the individual records were too variable to permit final conclusions to be drawn.

Attempts to determine the optimum amount of yeast, liver, and lettuce when added to the standard diet alone or in combination showed that combinations of one-half the optimum amount of each of the additions frequently, though not invariably, caused better growth than the full dosage of each separately. The combination of 0.2 gm. of yeast with 0.4 gm. of liver gave better results than either 0.4 gm. of yeast or 0.8 gm. of liver alone. It is suggested that the favorable results may be due to more suitable proportions of vitamins F and G furnished by the mixture. All of the components of vitamin B have been found to be present in the protein-free water extract of fresh liver, but it is suggested that they may not be present in the most favorable proportions.

The report also includes a progress report on the studies by Vickery and Leavenworth of the basic amino acids yielded by proteins (E. S. R., 60, p. 203).

Influence of chemistry on civilization.—Lecture I, The chemist at the breakfast table, J. C. IRVINE (*Indus. and Engin. Chem., 20 (1928), No. 9, pp. 884–888*).—A general discussion of the extent to which chemistry enters into the preparation of the food and equipment for an imaginary breakfast.

Market basket wisdom, D. DICKINS (*Mississippi Sta. Bul. [263] (1929), pp. 14*).—Data, presumably from the food consumption study previously noted (E. S. R., 59, p. 189), are given for the foods purchased and furnished by the farm for a family of two adults and three children, aged 16, 12, and 7 years, during two weeks in November, with comments on the wisdom from the standpoint of food value and economy of the expenditures reported.

The principles of bread-making, N. E. GOLDTHWAITE (*Colorado Sta. Bul. 344 (1929), pp. 37, figs. 12*).—This general discussion of the hows and whys of bread making, with directions for the straight dough and sponge processes, is designed primarily for the housewife, but is suitable for class lessons or demonstrations.

Eggs at any meal, L. M. ALEXANDER and F. W. YEATMAN (*U. S. Dept. Agr. Leaflet 39 (1929), pp. 8*).—This leaflet outlines the principles of egg cookery and illustrates them with typical recipes, giving times and temperatures required for the best results in the more usual ways of cooking eggs. In addition, recipes are given for fruit whips as illustrating the leavening power of egg whites and for custards, sauces, and salad dressings as illustrating the thickening properties of the yolks.

Vitamins A, D, and E and the oxidation of fats and oils, G. E. HOLM (*Science, 67 (1928), No. 1738, pp. 424, 425*).—The author reviews briefly the literature on the association of the fat-soluble vitamins with unsaturation and the destruction of these vitamins by oxidation. He states as his opinion tha

vitamins are labile states and not stable entities, but that oxidation may be involved in their formation as well as their destruction.

The fluorescence of some vitamin A-containing fats, R. S. MORGAN and K. MACLENNAN (*Biochem. Jour., 22 (1928), No. 6, pp. 1514–1522, figs. 4*).—A method is described by means of which fluorescence can be measured quantitatively in terms of shade and quality, the former being the measure of total light reflected from the sample illuminated by a beam from a quartz mercury vapor lamp in terms of the total light reflected from a standard white disc similarly illuminated, and the latter by the analysis of total light reflected into percentages of red, green, and blue. The method has been employed to measure the fluorescence of butter, cod-liver oil, and margarines, and to determine the effect of the addition to margarines of various substances.

The unsaponifiable matter of cod-liver oil was found to be brightly fluorescent, as previously noted by Peacock for cod-liver oil (E. S. R., 56, p. 110). "Jus," pure rendered beef fat used in margarine manufacture, has a slight fluorescence which is increased very markedly by the addition of a little of the unsaponifiable matter from the cod-liver oil. Hardened coconut oil has a bright blue fluorescence in comparison with the yellow of butter. On the addition of a sufficient excess of the unsaponifiable matter from cod-liver oil the blue fluorescence is reduced and the quality becomes similar to that of jus with added unsaponifiable matter. The blue fluorescence of margarine can also be modified by the addition of various pigments. A sample colored with sufficient red palm oil to match it with butterfat and with sufficient unsaponifiable matter from the cod-liver oil to bring it up to butterfat in vitamin A potency is said to match butterfat exactly in fluorescence.

The variability in vitamin content of human milks, I. G. MACY, J. OUTHOUSE, and H. HUNSCHER (*Jour. Home Econ., 20 (1928), No. 12, pp. 897–900, fig. 1*).—Supplementing the earlier studies on the vitamin content of pooled human milk (E. S. R., 57, p. 390), the authors have determined by the same methods the vitamin potency of two individual milks from women in the period of maximum milk production.

As judged by the growth records of experimental rats, the two milks contained approximately the same quantities of vitamin A but definitely less than the pooled milk in the previous study. In vitamin B potency one of the samples was inferior to the pooled sample and the other of about the same value. No tests were made for vitamin D, but both babies receiving the milk had definite rickets in the fourth and ninth months of nursing, thus showing the milk to carry an insuffiency of this vitamin.

In discussing these results it is suggested that the large volumes of milk being secreted by these women (from two to four times as much as that produced by those contributing to the pooled milk) may have been a contributing factor to the lower vitamin content. The diets of the two women were not controlled, but from two-day observations, made at intervals during lactation, it was estimated that while the women consumed equally large amounts of milk, the woman whose milk contained the smaller amount of vitamin B ate more fruits and vegetables and less cereals than the other. It is stated that the growth rate of each of the babies was satisfactory.

Microbic studies of acute infections in animals (albino rat) deprived of an adequate supply of vitamin A, R. G. TURNER (*Soc. Expt. Biol. and Med. Proc., 26 (1928), No. 3, pp. 233–235*).—The author, with the assistance of D. E. Anderson and C. G. Blodgett, has made a study of the bacteriological flora of the nasal cavities, posterior nasal aperture, and middle ear of normal rats and infected vitamin A-deficient rats with the finding that gram-negative cocci and gram-negative bacilli are the outstanding organisms in the latter. Of the

:ci, three types appeared to predominate, *Micrococcus catarrhalis*, *M. catarralis* subgroup A, and a microorganism classed in group 6 of the chromogenic pe. The gram-negative bacilli appeared to be closely related to the Friednder bacillus. Another type having no action on carbohydrates was observed a number of cases. Two of the cocci proved virulent to rabbits, while the iird type and the bacilli were avirulent. A comparison of the infected and ontrol rats showed a higher incidence of gram-negative bacilli and a lower f cocci in the control than in the infected rats.

It is noted that these experiments were carried out during the spring and ummer, and it is suggested that there is a possibility of seasonal variation in he types of organisms.

Vitamin B content of avocados, L. S. Weatherby and E. W. Waterman (*Indus. and Engin. Chem.*, *20* (*1928*), *No. 9*, *pp. 968–970*, *figs. 2*).—Fresh California avocados of the Fuerte variety and Calavo trade name, when fed in the amounts of 1.5, 3.5, and 5.0 gm. daily to young rats on a vitamin B free diet, promoted growth graded to the dose, the growth on the two larger amounts exceeding that on 0.25 gm. of dry yeast but not equaling that on 0.5 gm. of yeast. From this comparison of the growth curves with avocado and yeast it is concluded that the avocado has about one-twelfth the value of dry yeast as a source of vitamin B.

The vitamin B content of white bread baked with varying large amounts of yeast [trans. title], A. Scheunert and M. Schieblich (*Biochem. Ztschr.*, *202* (*1928*), *No. 4–6*, *pp. 380–386*, *figs. 4*).—Experiments with rats and pigeons are reported in which bread baked from 60 per cent wheat with the incorporation of 5, 15, and 30 gm., respectively, of dried yeast per 280 gm. of flour was used as the source of antineuritic vitamin for pigeons and vitamin B for rats. Both series showed that with the larger amounts of yeast some protection was secured and in the case of rats growth at a satisfactory rate.

Vitamin-B deficiency in infants: Its possibility, prevalence, and prophylaxis, G. W. Bray (*Roy. Soc. Trop. Med. and Hyg. Trans.*, *22* (*1928*), *No. 1*, *pp. 9–42*, *pls. 2*, *figs. 10*).—Vitamin B deficiency was found by the author to be quite prevalent and to be the cause of a high mortality rate among infants at Nauru, on Pleasant Island, in the central Pacific. As prophylactic and curative measures, yeast from fermented "toddy," the sap of coconut spathes, has been used with marked success.

Studies on the antineuritic vitamin.—II, The properties of the "curative" substance, J. L. Rosedale and C. J. Oliveiro (*Biochem. Jour.*, *22* (*1928*), *No. 6*, *pp. 1362–1367*).—The antineuritic properties of the extract of rice polishings prepared as described in the previous paper of the series (E. S. R., 58, p. 894) are reported to be destroyed by the natural fermentation of the extract resulting on standing at room temperature and also by sterilization either by heat or by filtration through a Büchner funnel.

The pancreas of pigeons suffering from polyneuritis of the dry type was found to be lacking in both proteoclastic and lipoclastic enzymes. This was also true of the human pancreas in dry beriberi. The curative extract of rice polishings contained lipoclastic but not proteoclastic enzymes. The authors are of the opinion that the curative substance has some control over the action of pancreatic enzymes.

Nitrogen exchange on a one-sided diet.—II, The nitrogen balance in fowls during B avitaminosis [trans. title], B. A. Lawrow and S. N. Matzko (*Biochem. Ztschr.*, *198* (*1928*), *No. 1–3*, *pp. 138–148*, *figs. 3*).—Attempts to determine the nitrogen balance of two fowls fed polished rice were unsuccessful on account of paralysis of the motor functions of the crop, which complicated the picture of B avitaminosis with that of inanition. In a further experiment with

one of the fowls the rice was substituted by oats and starch in such proportions that the total content of nirogen-containing and nitrogen-free constituents was equivalent to that of 60 gm. of rice.

During the period of oat feeding the body weight increased and the nitrogen balance was positive. On the retnrn to rice feeding the birds ceased to gain in weight. The nitrogen balance was positive at first, but from the seventh day became negative, and at the same time there was a fall in body weight. The uric acid excretion simultaneously showed a marked increase.

The authors conclude that the utilization of the nitrogen of the food was satisfactory, and that the negative nitrogen balance and increase in uric acid excretion were the results of an intensive disintegration of the nitrogen material of the body during the initial stages of B avitaminosis.

A comparison of cod liver oil and ultra-violet light for use in the prevention of rickets, A. D. Holmes, E. T. Wyman, L. W. Smith, and M. G. Pigott (*Amer. Jour. Diseases Children, 36 (1928), No. 5, pp. 952–965, figs. 10*).—A comparison is reported of the growth, Röntgenograms, and total ash of the femur and tibia and content of calcium and phosphorus of the blood serum of similar rats on a rachitic diet alone, supplemented with 4.9, 14.8, 19.8, and 29.7 mg. daily of cod-liver oil, the rachitic diet with the irradiation of the animals, and the same diet with 14.8 mg. of cod-liver oil and irradiation.

Aside from the control group, the average increase in body weight during the 36-day experimental period was greatest for the group fed 19.8 mg. of cod-liver oil and least for the groups receiving direct irradiation and 14.8 mg. cod-liver oil, respectively. The extent of calcification of the femur and tibia of all but the control group was practically the same. The calcium content of the blood serum of all but the controls showed a variation of less than 2 per cent. The phosphorus content of the irradiated animals was higher than that of the controls, but definitely lower than that of the other five groups. The product of the calcium and phosphorus content of the serum was 37.7 for the controls, 63.7 for the group receiving direct irradiation, and more than 84 per cent for the remaining groups.

It is concluded that 5 mg. of the cod-liver oil examined has sufficient antirachitic activity to protect laboratory animals against rickets under the conditions of the experiment, and that it affords greater protection than 15 minutes of irradiation with ultra-violet light at a distance of 36 in.

Antiricketic substances.—IX, Quantitative biophysical studies on the *activation of ergosterol*, C. E. Bills, E. M. Honeywell, and W. M. Cox, jr. (*Jour. Biol. Chem., 80 (1928), No. 2, pp. 557–563, figs. 2*).—In continuation of the studies previously noted (E. S. R., 60, p. 896), a series of parallel spectroscopic and biologic measurements was made on an irradiated alcoholic solution of exceptionally pure ergosterol. The procedure for activation differed from that of Morton, Heilbron, and Kamm (E. S. R., 58, p. 794) in that, instead of using one cell full of the solution and withdrawing succeeding samples for examination, separate cells were used for each period of activation, thus avoiding the possibility of changes due to oxidation.

A comparison of the curves of absorption and activation showed that at the time of highest activation, 22.5 minutes, there was no development of a new absorptive band, while at the time of the development of the new band at about 248 $\mu\mu$ the antirachitic potency of the oil had almost disappeared. This is contrary to the conclusions of Morton et al., who suggested that the product showing maximum absorption at 248 $\mu\mu$ is vitamin D.

Repeating the tests following the procedure of Morton et al., absorption curves similar to those reported by these workers were obtained. The band at 248 $\mu\mu$ developed and faded more rapidly than in the original series. The

ctivation curve was, however, very similar. It is concluded that oxidation plays a part in the destruction of the substance exhibiting this band. The substance is thought to have a molecular configuration similar to that of isoergosterol.

It is of interest that the maximum antirachitic potency in the present study was developed when about 73 per cent of the ergosterol was still present.

Source of increase in serum calcium induced by irradiated ergosterol, A. F. HESS, M. WEINSTOCK, and H. RIVKIN (*Soc. Expt. Biol. and Med. Proc., 26 (1928), No. 3, p. 199*).—This is a preliminary report of an investigation undertaken to determine whether for the production of the hypercalcemia resulting in infants and animals receiving excessive doses of irradiated ergosterol the calcium comes from the bones or tissues, or is simply the result of increased absorption from the intestines.

It was found possible to lower the blood calcium of young rats from the normal of 10 to 6.4 mg. per 100 cc. of blood within 24 hours by feeding a diet almost free from calcium and high in phosphorus. On feeding a large amount, 1 mg. daily, of irradiated ergosterol to rats prepared in this way the calcium content of the blood was rapidly increased by 50 per cent or more, although the animals were receiving only 0.8 mg. daily of calcium. This suggests that the calcium which is supplied to the blood following the feeding of irradiated ergosterol is derived from the tissues.

The fluctuations in the content of vitamins B and C in germinating cereal grains and the localization of vitamins B and C in the young plants *[trans. title], C. KUČERA (Ztschr. Tierzüchtung u. Züchtungsbiol., 12 (1928), No. 2, pp. 239–247).—In an attempt to follow the synthesis of vitamin C in cereal grains on germination, guinea pigs were fed wheat, rye, barley, and oats un-*germinated and germinated for different lengths of time. The amounts fed were not stated, but in all cases scurvy resulted with the seeds germinated at 12 hours. In the case of barley the animal receiving the sample germinated for 48 hours became scorbutic, although the one receiving the 24-hour sample did not. With the exception of oats and the 48-hour sample of barley, protection against scurvy was secured with the seeds germinated for 24 hours of more. With the oats scurvy occurred on all samples up to the one germinated for 96 hours.

The seeds, rootlets, and stems of plants germinated for six days were fed separately as sources of vitamin C to guinea pigs and vitamin B to pigeons and fowls. A limited amount of evidence is presented indicating that vitamin C was present in all three parts, but vitamin B only in the seeds.

Variations in the content of vitamins B and C in cereal grains during germination. The localization of vitamins B and C in the young plant [trans. titles], C. KUCERA (*Compt. Rend. Soc. Biol. [Paris], 99 (1928), No. 26, pp. 967–970, 971, 972*).—Essentially noted above.

Content of vitamin C in legumes during germination [trans. title], F. SIMONIK (*Compt. Rend. Soc. Biol. [Paris], 100 (1929), No. 6, pp. 431, 432*).—Following the same plan as in the study noted above, the author has traced the course of development of vitamin C in beans, vetch, and peas during germination. The earliest evidence of vitamin C was detected six hours after the beginning of germination, the amount increasing up to about five or six days, and then becoming constant. It is concluded that conditions are rather more favorable for the formation of vitamin C during the germination of legumes than of cereals.

The behavior of the antiscorbutic vitamin on sterilization [trans. title] E. REMY (*Ztschr. Untersuch. Lebensmtl., 55 (1928), No. 5, 385–393, figs. 10*).—A limited amount of evidence is presented on the vitamin C content of varion

canned vegetables. Cauliflower, green beans, green peas, and carrots were canned by cooking in slightly salted water, packing with the cooking water in glass jars, and heating at 98° C. for 60 minutes. Spinach was treated in the same way, except that the cooking water was discarded. Tomatoes were packed in jars and heated for 20 minutes at 80°. The cauliflower was tested after 1 month, the tomatoes after 7, and the other vegetables after 5½ months. All were fed in 70 gm. daily doses mixed with 50 gm. of the basal scorbutic ration. Protection was not secured with cauliflower, green beans, or carrots, but with the green peas and tomatoes protection against scurvy and growth took place. One of the two animals on spinach showed protection and the other not.

A new method for characterizing the immediate physiological action of water-soluble vitamins [trans. title], N. Bezssonoff (*Bul. Soc. Chim. Biol., 10 (1928), No. 9, pp. 1179–1198, fig. 1*).—A detailed description of the method noted from a preliminary report (E. S. R., 60, p. 295).

The immediate physiological effects of avitaminosis C [trans. title], N. Bezssonoff (*Bul. Soc. Chim. Biol., 10 (1928), No. 9, pp. 1199–1212*).—This paper reports experimental data obtained by the technic described in the above-noted paper with adult and young guinea pigs. Contrary to the results for adult guinea pigs noted in an earlier paper (E. S. R., 60, p. 295) the bromine-fixing power of the urine of young guinea pigs is said to be increased by vitamin C. The optimal dosage of vitamin C is given as four times the minimum dosage required for maintaining guinea pigs in good condition for 80 to 100 days when fed as a supplement to a scorbutic diet.

Metabolism in scurvy.—II, The nitrogen absorption and retention of guinea pigs, H. L. Shipp and S. S. Zilva (*Biochem. Jour., 22 (1928), No. 6, pp. 1449–1460*).—In continuation of the investigation noted previously (E. S. R., 60, p. 96), nitrogen metabolism experiments were conducted on three young guinea pigs on adequate and scorbutic diets and, in one case, on the adequate diet fed in insufficient amounts. The basal scorbutic diet used consisted of a mixture of bran, barley meal, middlings, and fish meal, mixed with warm water and fed ad libitum, together with a definite quantity of dried full-cream milk powder of constant composition. Decitrated lemon juice in amounts of 5 cc. daily was used in a preliminary experiment to determine the adequancy of the diet.

On the basal diet alone the intake did not begin to decrease until the early symptoms of scurvy were evident and, consequently, any changes in metabolism which might occur at the time of onset of scurvy could not be attributed to diminished food intake. No such changes, however, did take place, the nitrogen balance being unchanged until the food intake was diminished. In the final stage of scurvy there was a marked negative balance, but this was attributed to diminution in the food consumption.

The authors conclude that "there are no indications of a disturbed absorption or retention of nitrogen during the early stages of the development of scurvy in growing guinea pigs," and that "the nitrogen balance becomes negative only when the intake of food is diminished as a consequence of the disease."

Nitrogen balance and C/N coefficient of the urine in experimental scurvy not complicated by hunger [trans. title], N. Jabussowa (*Biochem. Ztschr., 198 (1928), No. 1–3, pp. 128–137, figs. 4*).—In this study the author attempted to overcome the difficulty of lowered food consumption during scurvy by feeding a guinea pig forcibly with powdered oats in the form of pills and with cabbage juice, fresh in the preliminary period of the metabolism experiment, and then boiled.

In the first four days on oats and fresh juice the nitrogen balance was negative. It then became positive and remained so, even after the substitution of

boiled for fresh juice, until about a week before death, at which time the disease was so severe as to disturb all of the regular functions. The C/N ratio of the urine almost doubled between the eighteenth and twenty-ninth days and then became normal shortly before the death of the animal.

The knowledge of D-vitasterols.—II, The activation of ergosterol [trans. title], A. JENDRASSIK and A. G. KEMÉNYFFI (*Biochem. Ztschr., 201 (1928), No. 4-6, pp. 269-280*).—Continuing the investigation previously noted (E. S. R., 60, p. 96), the authors prepared from yeast a very pure sample of ergosterol by repeated crystallization with ethyl alcohol and obtained with it on irradiation a preparation five times as active as that from ordinary ergosterol. The highest activity was secured with 30 minutes' irradiation, and on longer irradiation the activity was gradually destroyed. Repeated irradiation and removal of the active fraction finally left a product which could no longer be activated. The active preparation gave an orange color with iodine, while the inactive fraction, nonirradiated ergosterol, and overirradiated ergosterol gave no coloration with iodine.

The question of the standardization of vitamin D in butter and vitamin-containing margarine [trans. title], F. FLURY (*Biochem. Ztschr., 203 (1928), No. 1-6, pp. 14-21, figs. 6*).—Data are reported on the content of vitamin D, as determined by preventive tests with rats on the McCollum rachitic diet 3413, in three samples of margarine containing 0.3, 0.6, and 0.9 liters per ton, respectively, of Radiostol in oil solution, two samples of margarines without this addition, and a sample of the best sweet cream table butter. No rachitic changes, as judged by X-ray examination, were observed in the rats receiving the daily addition of from 0.1 to 0.2 gm. of the vitaminized margarines, but rats receiving similar amounts of butter developed rickets. On adding 0.2 gm. of the vitaminized margarines to the diet of the butter-fed rats definite signs of bone healing were observed in 10 days.

The possibility of thus rendering margarine superior to butter in its content of vitamin D is considered to be not only of nutritional but of economic importance.

" Hypervitaminosis " and " vitamin balance," L. J. HARRIS and T. MOORE (*Biochem. Jour., 22 (1928), No. 6, pp. 1461-1477, figs. 8*).—This is the detailed report with experimental data of an investigation noted previously from a summarized report (E. S. R., 60, p. 693).

Vitamine E and anaemia, C. L. KOHLS and H. M. EVANS (*Anat. Rec., 38 (1928), No. 1, p. 52*).—In this abstract of a paper reported at the 1928 meeting of the American Association of Anatomists it is reported briefly that lack of vitamin E alone does not produce anemia in rats. The blood picture of the second and third generation vitamin E-free rats differed in no way from litter mate-controls on a synthetic diet with adequate vitamin E and proved fertility or from that of rats on natural food.

The removal from vitamin E-free rats of blood equal to two per cent of the body weight on two successive days was followed by as rapid a regeneration of erythrocytes and leucocytes as that in animals on natural foods.

A note on the action of insulin in normal persons, L. KING, E. L. KENNAWAY, and A. PINEY (*Jour. Physiol., 66 (1928), No. 4, pp. 400-402*).—The experiments reported were conducted on a healthy male subject, weighing 78 kg. (172 lbs.) and taking an ordinary diet.

In a preliminary experiment 7 units of insulin, and later 15 and 11.5 units, were injected about 2½ hours after breakfast. The injection of the smaller amount of insulin was followed by some sweating and a feeling of muscular weakness. The symptoms following the larger amounts are described as fol-

lows: "(1) Profuse sweating, which begins from 1 to 1½ hours after the injection; (2) muscular weakness and tremor, which are sufficient to make writing rather difficult; and (3) extreme hunger."

Attention is called to the similarity between these symptoms and those brought about in an untrained person by prolonged and exhausting muscular exercise. It is thought that both states depend upon lack of available carbohydrates.

HOME MANAGEMENT AND EQUIPMENT

An analysis of the managerial responsibilities of the farm home maker, C. H. SCHOPMEYER (*U. S. Dept. Agr., Ext. Serv., Off. Coop. Ext. Work, 1929, pp. [2]+115*).—This mimeographed publication "consists of a detailed analysis of the managerial aspects of home making on the farm. The study is concerned primarily with those functions in home-management procedure that involve the making of choices or determinations when optional situations are confronted. The various situations in which a farm home maker performs managerial functions are indicated."

The study is not concerned with the routine physical practices of home making. The analysis is presented in tabular form under the following divisions: Budgeting money allotted from the annual family income for home-making expenses, foods for the household, clothing for the family, dwelling and house fixtures, house furnishings and equipment, household administration, development and care of the lawn, social and civic relationships, education, and participation in productive enterprises on the farm.

The column headings are explained by the author as follows: "The optional situations have been designated in this analysis form as an inquiry. An optional situation implies that there is a set of alternatives present from which a selection may be made. A group of possible alternatives has been worked out for each optional situation presented in this report and is listed under a heading alternatives. In each optional situation the home maker confronts, she finds certain facts, conditions, or forces exerting a determining influence upon her selection among the alternatives in the group. She should be aware of these, if she is to make a wise choice among the alternatives she faces. Such of these influences which have been recognized as effective have been stated in an abstract form and classified as determinant elements in this analytical scheme. Under this classification will be found references to influences such as the home maker's personal ideals of excellence, her past experiences, her observations, her attitudes, certain ideals and capabilities of other members of her family, her own capacity, the economic and social status of the family, applicable data from surveys, investigations and research, and experience others have had in a similar situation. The main divisions and subdivisions of the subject were made largely as a matter of convenience."

MISCELLANEOUS

Thirty-ninth Annual Report [of New Mexico Station, 1928], F. GARCIA (*New Mexico Sta. Rpt. 1928, pp. 68, pl. 1, figs. 5*).—This contains the organization list, a report of the director on the work and publications of the station, and a financial statement for the year ended June 30, 1928. The experimental work reported is for the most part abstracted elsewhere in this issue.

Abstracts of Bulletins 366–392 and Circulars 48–52, A. D. JACKSON (*Texas Sta. Circ. 54 (1928), pp. 27*).—The publications abstracted have been previously noted. Abstracts of several articles appearing in scientific and popular journals are appended.

NOTES

California University and Station.—Dr. R. G. Sproul, vice president and comptroller, has been appointed president of the university effective July 1, 1930, succeeding Dr. W. W. Campbell, who is to retire on the previous day.

Supplementary appropriations to the College of Agriculture by the State legislature include $10,000 for a study of B. C. G. vaccination of dairy cattle as a possible protection against bovine tuberculosis and $10,000 for an investigation of the economic problems of agriculture in California.

Connecticut Storrs Station.—*Science* notes that Dr. James G. McAlpine, bacteriologist in animal diseases, has resigned.

Minnesota University.—Lola M. Cremeans, head of home economics at the West Central School and Morris Substation, has been appointed head of the home economics department of the Alaska College. Allene Sewell, instructor in home economics, has also been appointed to a position in the same institution.

Wylle B. McNeal, head of the home economics division of the university has been granted a year's leave of absence for graduate work in Columbia University. During her absence Paulena Nickell will act as chairman of the committee for home economics. Hazel Thomas, assistant in foods, has accepted a position as instructor in foods in the North Dakota College.

Missouri Station.—A research tabulation machine known as a selecto-meter is being developed by the research laboratory of the department of rural sociology. The machine as now installed consists of: (a) Twenty-four vertically mounted 3-sided boxes, each face of which has 8 vertical columns of 235 holes each into which brass plugs can be inserted in tabulating data. By revolving the boxes a tabulating surface is provided sufficient to take care of 576 cases with a stub containing 235 items. (b) A frame which can be moved horizontally across the tabulation surface, which is provided with a contact clip for each row of horizontal holes in the tabulation surface, and on which is mounted an electromagnetic counting device which can be connected up so that it will register when any single contact clip or any combination of clips make contact with the brass plugs inserted in the tabulation surface, thus making it possible to secure the distribution of any selected item in combination with any other item or combination of items.

The machine may be operated by student labor and is thought to be adaptable to statistical computations in other fields, such as genetics.

Ohio State University.—Lyman E. Jackson, instructor in agricultural education in the University of Minnesota, has been appointed professor of agricultural education vice Hershel W. Nisonger, who has become junior dean of the College of Agriculture. W. F. Stewart, professor of agricultural education, has been given leave of absence for graduate study at Columbia University during the coming year. J. P. Schmidt of the department of rural sociology has been appointed director of farmers' institutes vice F. L. Allen, deceased.

Instruction and Research in the Maple Sugar Industry in Quebec.—Since 1914 the Quebec Government has carried out systematic instruction in the manufacture of maple sugar and sirup, with a school operating under skilled sugar makers and traveling instructors employed to give practical instruction throughout the maple-producing districts of the Province. Modernization of methods has resulted in a vast improvement in the Province, which produces

about 70 per cent of the Dominion output. The Maple Sirup and Sugar Makers' Association of Canada, with headquarters at Quebec, has recently announced its intention of awarding a scholarship for maple products research under the National Research Council at Macdonald Agricultural College.

New Journals.—The *Canadian Journal of Research* is being published bimonthly by the National Research Council, Ottawa, Canada. While intended primarily for the publication of the results of work carried out under the auspices of the council, it will also be open for suitable papers from other Canadian research workers. The initial number contains the following original articles: Studies on the Nature of Rust Resistance in Wheat, by R. Newton, J. V. Lehmann, and A. E. Clarke; The Hydration of the Aluminates of Calcium.—I, A New Crystalline Form of Hydrated Tricalcium Aluminate, by T. Thorvaldson and N. S. Grace; Vaccination against Tuberculosis with Bacillus Calmette-Guerin, by A. C. Rankin; Studies on the Nature of Rust Resistance in Wheat.—IV, Phenolic Compounds of the Wheat Plant, by R. Newton and J. A. Anderson; and The Effect of the Ultra-Violet Component of Sunlight on Certain Marine Organisms, by A. B. Klugh.

Der Züchter, a journal for theoretical and applied genetics, is being issued monthly at Berlin, W. 9, Linkstrasse 23/24, by the Society for the Promotion of German Plant Breeders and the Kaiser Wilhelm Institute for Breeding Investigations. The initial number contains the following original articles: Breeding and Cytology, by K. Bělař; The Feasibility of Experimental Production of New Plant Races by Skilful Analysis of Mutations, by H. Stubbe; White Recessives and Wild Boar Stripings in Mangulitza Swine, by H. P. Ossent; Xenia Formation in Barley, by H. Kuckuck; The Breeding of Wart Resistant Potato Varieties, by E. Köhler; The Grower of New and Unknown Grains and Progress in Mechanical Seed Improvement, by Griesbeck; Ludwig Wittmack, by K. von Rümker; The All-Russian Congress for Genetics and Animal and Plant Improvement in Leningrad of January, 1929; and Cytological Investigations of Stone and Kernel Fruits, by E. Oehler.

Phytopathologsche Zeitschrift is being issued from time to time at Hedemannstrasse 28/29, Berlin, S. W. 11, with Dr. E. Schaffnit as editor, as a continuation of *Forschungen auf dem Gebiet der Pflanzenkrankheiten und der Immunität im Pflanzenreich*. The initial number contains the following original articles: The Dependence of the Infection Ratio of Cereal Rusts on the CO_2 Content of the Air, by G. Gassner and W. Straib (pp. 1–30); The Yellowing of Young Cucumbers, Due to a Cephalosporium, and Its Leathery Fruits, by H. Klebahn (pp. 31–44); Pathological Effect of Uranium Rays on *Olea europaea*, by L. Petri (pp. 45–48); The Biochemistry of Potato Rots, I, by E. Lepik (pp. 49–109); and A New Root Rot of Sugar and Fodder Beets, by A. Meurs (pp. 111–116).

Wissenschaftliches Archiv für Landwirtschaft is being published at Berlin, W. 9, Linkstrasse 23/24. Section A, *Pflanzenbau*, is edited by T. Roemer, its initial number containing the following original articles: The Problem of the Water Economy of Agricultural Crop Plants in Critical Experimentation, by A. Arland (pp. 1–60); The Influence of Shrinkage on the Water Movement and Aeration of Different Soils, by G. Pieper (pp. 161–225); and Miscellaneous Investigations on the Estimation of the Lime Requirement of Soils, by G. Rohde (pp. 226–272).

International Review of Educational Cinematograph is being published monthly in English at Rome by the International Educational Cinematographic Institute of the League of Nations. The initial number contains an article entitled The Institute in the Field of Agriculture.

O

EXPERIMENT STATION RECORD

Vol. 61 SEPTEMBER, 1929 No. 4

The passage on June 15 of the Agricultural Marketing Act has raised many important questions, and among them is the significance of the legislation to research. Although the act is not commonly thought of as a measure directly related to research and the term itself receives but a single mention in its text, there is reason to believe that at least indirectly its influence in this field may be considerable. Likewise, while the machinery to be set up under the new legislation does not directly include the agricultural colleges and experiment stations, practically every agricultural economist and many other college and station workers have been more or less actively studying some phase of the problems which it is designed to aid in solving, and its operations seem certain to introduce new factors of importance into their research and teaching.

The primary object of the new act is set forth in its introductory section, which declares it to be the policy of Congress "to promote the effective merchandising of agricultural commodities in interstate and foreign commerce, so that the industry of agriculture will be placed on a basis of economic equality with other industries." To that end it is designed to protect, control, and stabilize the currents of this commerce by minimizing speculation, by preventing inefficient and wasteful methods of distribution, by encouraging producer owned and controlled cooperative organizations for greater unity of effort in marketing, and by aiding in preventing and controlling surpluses in any agricultural commodity through orderly production and distribution.

As the executive agency to administer the act, there is created a Federal Farm Board. This board is made up of the Secretary of Agriculture, ex officio, and eight members selected by the President, with "due consideration to having the major agricultural commodities produced in the United States fairly represented upon the board." The appointed members will receive salaries of $12,000 each and must not actively engage in any other business or employment save the operation of their own farms or otherwise be financially in-

terested in any agricultural commodity or product thereof. Their terms are at first staggered over a six-year period, but will eventually be of six years each. Subject to the confirmation of the appointed members by the Senate, the initial membership of the board has been completed as follows: Chairman, Alexander Legge of Illinois, for one year; vice chairman, James C. Stone of Kentucky, for five years, and representing tobacco; the Secretary of Agriculture, member ex officio; Carl Williams of Oklahoma, for six years, cotton; C. B. Denman of Missouri, for three years, livestock; Charles C. Teague of California, for one year, fruits and vegetables; William F. Schilling of Minnesota, for two years, dairying; Charles S. Wilson of New York, for four years, general farming; and Samuel R. McKelvie of Nebraska, for two years, wheat. Chris L. Christensen, head of the Division of Cooperative Marketing in the U. S. D. A. Bureau of Agricultural Economics, has accepted an appointment as secretary of the board, and its activities are already under way.

The adequate representation of the various commodities is further safeguarded by a provision for the selection by the cooperative associations handling a commodity of an advisory commodity committee of seven members, of whom at least two members must be experienced handlers or processors of the commodity. These commodity committees are to meet at least twice annually, to represent their groups whenever necessary before the board, and to cooperate with it in advising producers in the development of suitable programs of planting or breeding.

In addition to an administrative fund of $1,500,000 for the use of the board and its commodity committees for the period ending June 30, 1930, there has been appropriated a revolving fund of $500,000,000. This revolving fund is intended to be drawn upon as needed for loans to cooperative associations and stabilization corporations and for the furnishing of insurance to the cooperative associations against loss through a decline in prices.

The loans to cooperative associations are provided to assist in the effective merchandising of agricultural commodities and their food products, the construction or acquisition of physical marketing facilities, the formation of clearing house associations to foster economic distribution and minimize waste and loss, the enabling of the cooperative associations to advance to their members a greater share of the market price of the commodity than is practicable under other credit facilities, and the extending of the membership of the associations by a campaign of education. In a similar way the stabilizing corporations which may be organized for the preparing, handling, storing, processing, and merchandising of specific commodities may be granted loans to provide working capital or attempting a control of

surplus under prescribed conditions. Neither loans nor insurance are to be supplied, however, if in the judgment of the board the result would be to increase unduly the production of a commodity in which a surplus is commonly produced in excess of the annual marketing requirements.

These important and varied functions of the board have been entrusted to it as a means of advancing the general welfare. Great discretionary authority is granted, but with the expectation that it will be exercised judiciously, not merely with avoidance of arbitrary decisions and class discriminations but also with a background of adequate and accurate information. Such a condition makes it well-nigh inevitable that if the new legislation is to succeed it must rest on a firm foundation of facts. Accordingly the board is given broad powers along the lines of education, research, and extension. It is specifically empowered to promote education in the principles and practices of cooperative marketing and to encourage the organization, improvement in methods, and development of effective cooperative associations. It is to "keep advised from any available sources and make reports as to crop prices, experiences, prospects, supply, and demand, at home and abroad," and is to "investigate conditions of overproduction of agricultural commodities and advise as to the prevention of such overproduction." Finally, it is authorized and directed to make investigations and reports and publish the same, including such questions as the following: Land utilization for agricultural purposes, reduction of the acreage of unprofitable marginal lands in cultivation, methods of expanding markets at home and abroad for agricultural commodities and food products thereof, methods of developing by-products of and new uses for agricultural commodities, and transportation conditions and their effect upon the marketing of agricultural commodities.

Much work has already been done or is now under way by various existing agencies in some of these fields, and the board is directed to endeavor to avoid preventable expense and duplication of effort by availing itself of the services and facilities of any governmental establishment in the executive branch of the Government, including any field service. Specifically the board shall "through the Secretary of Agriculture indicate to the appropriate bureau or division of the Department of Agriculture any special problem on which a research is needed to aid in carrying out the provisions of this act." Another clause in the act empowers the President to direct any governmental establishment to furnish to the board any public information which it may have pertaining to the functions of the board. He may also "transfer to or retransfer from the jurisdiction and control of the board the whole or any part of (1) any office, bureau

service, division, commission, or board in the executive branch of the Government engaged in scientific or extension work, or the furnishing of services, with respect to the marketing of agricultural commodities, (2) its functions pertaining to such work or services, and (3) the records, property, including office equipment, personnel, and unexpended balances of appropriation, pertaining to such work or services." These powers are very sweeping, and while no radical changes in organization or procedure may be deemed necessary, it is apparent that the way has been opened for the effective mobilization of all available Federal agencies and the active prosecution of a comprehensive, well coordinated, and thoroughgoing program of agricultural economics research and extension.

In a recent address by the Secretary of Agriculture this matter of relationships is discussed in some detail. "I do not believe," the Secretary stated, that "Congress intended to create another Federal agency with duties overlapping those of the Department of Agriculture. Such a course would weaken one or both. I do believe Congress expected that the board would supplement some parts of the work of the Department. I know that the firm conviction of both the board and the Department is that they exist solely to achieve the maximum of results for agriculture, and that these results can best be accomplished by close cooperation. . . .

"The general program is one of reorganizing agriculture in many respects, with the Farm Board taking the active and immediate leadership. The board will be on the firing line. The Department will to a large extent make and supply the ammunition. The research already done by the Department—the facts developed and developing—will provide the economic basis for such action as the board may take. In like manner the board will, no doubt, call upon the other great departments of the Government, such as State, Treasury, Interior, Commerce, and Labor, for facts in their possession which bear upon its problems."

In addition to its relations with other Federal agencies, the board is also authorized to cooperate with any State or Territory or any department, agency, or political subdivision thereof or with any person. This cooperation, of course, is entirely on a voluntary basis, but has large possibilities.

So rapid has been the development of economic research in the experiment stations since the passage of the Purnell Act in 1925 that the amount of attention which these institutions are now giving to this field is not always realized. At the present time no fewer than 45 States have active Purnell projects, aggregating 135 in number, in marketing alone. There are also 13 miscellaneous economic studies

of related interest, 34 projects dealing with the economics of production, 27 projects with cost of production, and 54 in farm management. Each of the 48 States is represented by projects in one or more of these lines. Many of these studies deal directly with some phase of agricultural cooperation and the cooperative movement. Some of them have only recently gotten under way, but not a few have been in progress for a considerable period and are already yielding results of great interest and value. Practically every issue of the *Record* contains abstracts of material contributions of the stations in this field, effectively supplementing and extending the work of the Department.

For a time the effect of the Agricultural Marketing Act upon this research may be more or less intangible, but in the end it seems certain to be an appreciable factor. Apparently no one now expects this legislation or any other single measure to solve all the ills of agriculture, and the extent of its influence can not now be predicted with any confidence, but it would be surprising if an innovation of its magnitude did not ultimately lead to many readjustments of the business of farming and modify considerably the details of farm practice and farm life.

The experiment stations and all other research agencies should be prepared to do their share in coping with the new problems which seem certain to be raised. Of course, this does not mean a wholesale abandonment of existing projects, but rather a gradual change of emphasis and in some cases, it may be, a redirection of certain activities. Doubtless there will be an accelerated trend toward greater coordination of research along both commodity and regional lines, as in the recent formation within this Department of a cotton research coordinating committee, a pecan research committee, and a special committee on range problems and policies. It may be well to be ready for such developments and to be in a position to take advantage of such as seem most desirable. Because of these possibilities the new legislation seems likely to bring to research a stimulating incentive, an attractive opportunity, and a serious responsibility.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

The amino-acids of flesh.—II, Comparison of the diamino-acid content of some normal and pathological tissues, J. L. Rosedale (*Biochem. Jour., 22 (1928), No. 3, pp. 826–829*).—In the author's previous work (E. S. R., 47, p. 610) on this subject only slight differences were found to exist between the diamino-acid contents of the normal muscle tissues of the various farm animals considered, "although it was pointed out that available methods of analysis did not insure complete accord even when duplicates were made upon the same hydrolysate." Subsequent work directed toward the improvment of the methods found incompletely adequate in the work above noted is briefly reviewed, and the details of the procedure employed in the present comparative investigation of normal and carcinomatous tissues are described.

No fundamental differences were encountered in the results obtained by the Van Slyke method (E. S. R., 26, p. 22) as used in the work here described and by the modification of the Kossel method as here used. The diamino-acid contents of the tissues of the various animals and of different parts of the normal animal appeared similar. In carcinomatous tissue and in the muscle of chickens which had had their food protein entirely from maize a low content of lysine was found.

The data given comprise the total nitrogen, nitrogen distribution as determined by the Van Slyke (modified) method, and percentages of amino acids, arginine, histidine, lysine, etc.

The ultra-violet absorption spectra of certain aromatic amino-acids and of the serum proteins, F. C. Smith (*Roy. Soc. [London], Proc., Ser. B, 104 (1929), No. B 730, pp. 198–205, figs. 2*).—Measurements were made of the ultraviolet absorption curves of tyrosine, tryptophane, and phenylalanine and of the proteins both of human and of horse blood sera, with the result in part, of the observation of two new absorption bands in the tyrosine spectrum, and the finding of values considered to be "in very close agreement" in the cases of the proteins of human and horse blood sera.

It was further concluded that "the ratio $\frac{\text{extinction coefficient at head of curve}}{\text{extinction coefficient at foot of curve}}$ *may be taken as an index of purity of a given sample of protein. It has been shown that error is not introduced by 'scattering' of the radiation due to the colloidal condition of the proteins.*"

A method based on the absorption spectra for determining the ratio of albumin to globulin in a mixture of the two is suggested.

Studies on lipin-protein complexes.—I, Lecithin-caseinogen complexes, T. R. Parsons (*Biochem. Jour., 22 (1928), No. 3, pp. 800–810, figs. 5*).—"It has long been known that lipins and proteins form loose 'compounds' . . . but up to the present no certainty seems to have been reached as to whether the constituents of these compounds are united merely by surface forces or whether their association is of a more intimate chemical nature." Investigating

this subject, the published work upon which is summarily considered, the author presents findings and conclusions among which are the following:

The percentage of lecithin in the precipitates obtained by the addition of a mixture of lecithin and casein to a series of buffer solutions increases with increases in H-ion concentration of the medium. When mixtures of casein with progressively increasing proportions of lecithin are added to the same buffer solution, the percentage of lipin in the various precipitates increases rapidly at first and then more and more gradually "until a stage is reached at which very considerable further increase of the total proportion of lecithin added produces but slight increase in the percentage of this constituent in the precipitated complex." The results stated are explained as a mutual precipitation of two colloids "whose opposite charges vary in intensity with the H-ion concentration of the dispersion medium."

The data submitted in support of the theory above indicated are presented principally in various graphic forms.

The isolation of pure *l*-proline, B. W. Town (*Biochem. Jour., 22 (1928), No. 4, pp. 1083-1086*).—The method described is believed to permit of the preparation of *l*-proline in a particularly high state of purity, the product obtained by the author having shown an optical rotation distinctly higher than that indicated in the previous records.

The mixed amino-acid solution, obtained in the present case by the hydrolysis of wheat gliadin, was quantitatively freed from the sulfuric acid used for the hydrolysis of the protein by means of baryta and was treated with a moderate excess of copper carbonate, concentrated to a sirup, diluted and filtered, and again concentrated to a sirup in the presence of some copper carbonate. Repeated treatment of the viscous mixture with dry acetone caused a rapid granulation of the copper salts and permitted rapid drying. "The whole success of the method depends on the rapid and efficient drying which the acetone effects." Fractionation by extraction with absolute methyl alcohol and further acetone treatment is detailed, and the properties of the *l*-proline preparation obtained are described as follows:

"Pure proline is a white, nondeliquescent solid. It crystallizes quite easily from strong aqueous solutions in the form of long needles. It is not very soluble in cold absolute alcohol, but dissolves readily in the hot solvent, crystallizing out on cooling, also in needle-shaped crystals. It may also be recrystallized from isopropyl alcohol. It melts with decomposition at 215°. It gives absolutely no amino nitrogen in the Van Slyke apparatus.

"N (Kjeldahl)—Found: 12.20 per cent. Calculated: 12.17 per cent. C and H—2.370 mg. gave 4.540 mg. CO_2, 1.682 mg. H_2O. Found: C, 52.25 per cent; H, 7.90 per cent. Calculated: C, 52.14 per cent; H, 7.88 per cent. Rotation: (1) 0.6206 gm. in 50 cc. water gave, in a 2-dm. tube, a rotation of −2.15°; whence $[\alpha]^{18°}_D = -86.6°$. (2) 1.734 gm. in 50 cc. water gave, in a 2-dm. tube, a rotation of −6.02°; whence $[\alpha]^{18°}_D = -86.8°$."

The procedure described involved the separation of the mixture of copper salts into the three fractions (1) soluble in water and in methyl alcohol; (2) soluble in water, insoluble in methyl alcohol; and (3) insoluble in either methyl alcohol or water.

The action of carbon monoxide on the autooxidation of sulphydryl compounds, M. Dixon (*Biochem. Jour., 22 (1928), No. 4, pp. 902-908, figs. 5*).—Carbon monoxide was found without effect on the rate of autooxidation induced in cysteine or in reduced glutathione by the addition of salts of copper or of iron, or by adding freshly dissolved hematin. When the hematin solution was allowed to stand for several days, however, although the resulting mixture of

simpler iron compounds had the same catalytic power as had the original hematin solution, the catalysis was markedly inhibited by carbon monoxide.

On the application of the Donnan equilibrium to the ionic relations of plant tissues, G. E. BRIGGS and A. H. K. PETRIE (*Biochem. Jour., 22 (1928), No. 4, pp. 1071–1082*).—From a largely theoretical investigation, based on data already available, it is concluded in part that the concept of a simple Donnan equilibrium operating between two homogeneous phases does not adequately explain the phenomena of the intake of ions by plants. The available experimental evidence is taken as indicating that the product of the apparent internal concentrations of cations and anions, the basis of the total volume of the tissue, may be greater than that of the external concentrations of the two ions, whereas the above-mentioned concept would require equality as between these products.

"It is pointed out that the interior of the tissue comprises a number of phases, each of which may be in Donnan equilibrium with the external solution. The product of the apparent internal ionic concentrations resulting from the total effect of all these internal phases is shown under such circumstances to be greater than the external product. Even in such a system as this, however, if the ratio of the apparent internal to the external concentration of a cation is greater than unity, the same ratio of the corresponding anion should be less than unity; whereas the experimental evidence indicates that both may at times be greater than unity. It is shown that this may be accounted for if we suppose that one internal phase contains indiffusible cations and that another contains indiffusible anions. The effect of temperature on the relative uptake of the cation and anion of a salt can be interpreted in terms of its possible effect on the dissociation of the tissue colloids."

A convenient method for potentiometric volumetric analyses [trans. title], E. MÜLLER and H. KOGERT (*Ztschr. Analyt. Chem., 75 (1928), No. 6, pp. 235–239, figs. 5*).—The modification of method proposed consists in substituting for the special outside reference electrode a wire or a metal the same as that constituting the titration vessel electrode but inclosed in a capillary tube, about the outside of which the wire constituting the electrode in contact with the solution for titration is wound in a spiral. The capillary tube having a very small inside diameter, the solution in the tube does not change in composition as the titration proceeds but is in liquid junction with the main body of the solution at the tip of the capillary. A difference in potential between the two electrodes is developed, therefore, and in the experiments here reported was found to show the sharp inflection at the end point characteristic of systems using an outside reference electrode.

Potential curves for the titrations of a lead salt with potassium ferrocyanide, of hydrochloric acid with sodium hydroxide, and of a mixture of chlorides and iodides with silver nitrate solution are shown as obtained with the new device, and the numerical data obtained both with the simplified apparatus and with the usual calomel reference electrode are presented in comparative tables. The volume of solution withdrawn from reaction by the capillary tube was but from 0.03 to 0.05 cc. from a total solution volume of 100 cc., so that the error from this cause could not exceed 0.05 per cent; and it is considered that a definite correction for this small error could be made.

The results cited are in close agreement with those given as obtained for the same solution by means of the usual form of reference electrode. The device is illustrated with a simple mounting providing for its electrical connection with the remainder of the measuring system.

Hydrogen ion determination by a modified colorimetric method, D. H. CAMERON (*Jour. Amer. Leather Chem. Assoc., 24 (1929), No. 2, pp. 76–80*).—For the range pH 4 to pH 9.8 the method described requires M/10 potassium hydrogen phthalate, M/10 potassium hydrogen phosphate, M/10 boric acid, and either N/5 sodium hydroxide or a sodium hydroxide solution of approximately this concentration, the exact factor of which is known. The usual sulfone, phthalein, and other indicators are used.

A 50-cc. portion of the solution of unknown H-ion concentration (the method is to be applied only to water white solutions) is placed in a 50-cc. Nessler tube, and exactly 1 cc. of a dilution of 1 cc. of the suitable indicator solution to 5 cc. distilled water is added. In a second tube of dimensions exactly the same as those of the sample tube, 25 cc. of the buffer acid solution corresponding to the indicator required by the unknown sample is treated with exactly 1 cc. of the diluted indicator solution and is then titrated to a color match with the sample solution by means of the sodium hydroxide solution, the volume of the buffer solution being "brought to very near 50 cc. before the time of the final color comparison by the judicious use of distilled water during the titration process." The composition of the buffer solution being known from the quantity of the standard sodium hydroxide solution used, the pH value is read from a table of the known pH values of mixtures of the components used.

It is suggested that by the use of M/10 potassium chloride and M/10 potassium hydrogen phthalate with N/5 hydrochloric acid as titrating solution, the pH range below 4.0 may also be covered by the same method. Of the procedure above outlined for the range above pH 4 it is stated that "an accuracy of ±0.05 of a pH unit should be easily obtained."

Determination of hydrogen ion concentrations in phosphate and borate mixtures by means of the quinhydrone electrodes, E. BIILMANN, A. KLIT, and T. SWAETICHIN (*Biochem. Jour., 22 (1928), No. 3, pp. 845–854*).—A discussion of theoretical considerations and brief notes on the previously published work accompany an account of a comparative experimental study of the quinhydrone, quinoquinhydrone, and hydroquinhydrone electrodes, with reference to the hydrogen electrode, in phosphate and in borate buffer mixtures. The potentials of these various electrodes were determined for phosphate mixtures over the range pH 5.90 to pH 8.04, and for the borate mixtures through the range pH 7.34 to pH 8.05.

The simple quinhydrone electrode gave correct pH values in phosphate mixtures up to 7.73 and very good values at pH 8.04; in the borate mixtures it gave correct values. The quinoquinhydrone electrode gave correct values in phosphate mixtures up to pH 7.38. In more alkaline phosphate mixtures and in the borate mixtures the potentials were very drifting.

The hydroquinhydrone electrode gave very stable potentials in the phosphate mixtures, but too low pH values because of the acid influence of the hydroquinhydrone. The influence of the quinol was determined by means of the colloidal palladium hydrogen electrode. The influence may be eliminated by using a comparison electrode of a similar type. Owing to the acid influence of quinol, corrections must be introduced in certain measurements with hydroquinhydrone electrodes in phosphate and bicarbonate solutions.

Determining total solids of certain liquids, H. H. KRAUSE (*Chemist-Analyst, 17 (1928), No. 4, p. 14*).—The procedure described was found by the author to be simple and rapid as applied to rubber latex, and is here suggested as probably applicable to many liquids the solid content of which will form a coherent film when dried.

Fill a weighing bottle to about two-thirds of its capacity with the liquid and weigh. Dip a test tube of a diameter of about 1 in. into the liquid, remove quickly, and rotate the tube to prevent dropping of liquid from it while replacing the cover of the weighing bottle and until the liquid has become filmed sufficiently to permit setting it up on end in the drying oven. Determine the weight of the film by reweighing the weighing bottle, and if the film is removable when dry, weigh it directly; otherwise use weighed tubes and reweigh when the film has dried.

It is noted that the thinness of the film and the exposure due to its position on the outer surface of the tube render drying very rapid and thorough. The figures obtained for duplicate determinations were found to check to three significant figures.

A method for the estimation of the salt content from the pH value of apple juice, and some comparative analyses of the mineral content of the juice and whole apple, D. Haynes and J. W. Brown (*Biochem. Jour., 22 (1928), No. 4, pp. 947–963, figs. 2*).—The method proposed consists basically in the determination of a quantity designated the "equivalent potash," estimated from the comparison of the pH values and titrable acidity of the apple juice under examination with the corresponding figures for a series of mixtures of potassium malate and malic acid. "It is shown . . . that if the pH and titrable acidity of the juice of acid apples is measured, it is possible to obtain a fairly reliable idea of its salt content by comparison with the acidity and pH of mixtures of malic acid and potassium malate of known concentration." A considerable proportion of the experimental work reported consists in the elimination of various factors considered to be theoretically possible sources of error. Extensive numerical data are given.

"The same percentage of potash was found in the expressed juice as in the whole apple, indicating that most of the potash of the apple is present in the cell sap. Larger percentages of magnesia and lime were found in the juice than in the whole apple, from which it is concluded that the juice has dissolved lime and magnesia from the cell wall. There is some evidence that this solution of cell wall material by the juice varies with the acidity of the juice."

On the determination of the moisture and crude fat content in substances high in fat [trans. title], N. D. Prjanischnikow and S. M. Tolnow (*Ztschr. Analyt. Chem., 76 (1929), No. 5–6, pp. 161–166, figs. 2*).—Moisture methods depending on the distilling out of the water with boiling hydrocarbons (toluene, xylene, etc.) are criticized as subject to error, except when very large samples are used, on account of the formation of emulsions of the water with the hydrocarbon and also by reason of the clinging of drops of the water to the sides of the graduated receiving tube. It was found possible to remedy this condition, however, by adding from 4 to 6 per cent of normal amyl or isobutyl alcohol to the benzine, used by the authors in place of the aromatic hydrocarbons. Solution of the alcohol in the water caused the moisture results as directly read to be too high; but the error so introduced was shown to be constant, so that accurate correction could be made, the correction being 6.0 per cent of the water as collected when 6 per cent of isobutyl alcohol was added to the benzine and 1.2 per cent (average) when normal amyl alcohol to the extent of 4 per cent was used.

In the fat extractions the presence of the small quantities of alcohol used did not affect the results in the case of either alcohol.

On the basis of these findings a combined fat extraction and moisture determination was made by means of an apparatus in which the sample was placed in an extraction thimble held in a suitable shell in the widened upper part of

the neck of the solvent flask, so that the sample was heated by the rising solvent vapors and extracted by the solvent condensate returning after the subsidence from it of its suspended water content into the measuring tube. A microburette permitted readings of the water content of the sample to 0.01 per cent.

Examples of the results obtained in the extraction and moisture determination as carried out with samples of known composition are given both for a benzine + 6 per cent amyl alcohol mixture and for a benzine + 6 per cent isobutyl alcohol solvent, the figures shown indicating very satisfactory determinations both of moisture and of fat by either solvent mixture.

The form of apparatus required by the combined determination method is described and illustrated.

A rapid volumetric determination of glucose, C. A. Amick (*Chemist-Analyst, 17 (1928), No. 4, pp. 10, 11*).—A cuprimetric method for glucose said to furnish a rapid and reliable determination without the inconveniences attendant upon the use of tartrate solutions is described as follows:

"Thirty cc. of a molar copper sulfate solution and 50 cc. of distilled water are heated to boiling in a 250-cc. Erlenmeyer flask. Ten cc. of the glucose solution (or the unknown in distilled water and made up to 10 cc.) and 10 cc. of a 6 N carbonate-free sodium hydroxide solution are added in the order named. The copper hydroxide which is formed is a very finely divided suspension and is admirably suited for an oxidant. Continue the heating on a water bath for 15 minutes, then remove the flask and cool in ice water to room temperature. Introduce into the flask 50 cc. of phosphomolybdic reagent made by adding 100 gm. of sodium molybdate to 500 cc. of H_2O, adding 75 cc. of 85 per cent phosphoric acid, 275 cc. of concentrated sulfuric acid, and sufficient water to make a total volume of 1,750 cc. The clear phosphomolybdic reagent is reduced to a greenish blue when added to the solution containing the cuprous oxide and is then titrated by standard permanganate. The end point is the disappearance of the greenish blue color. The above oxidizing solution is sufficient for 1.500-2.000 gm. of glucose."

Volumetric determination of arsenic in the presence of organic matter, the halogens, and heavy metals [trans. title], E. Schulek and P. von Villecz (*Ztschr. Analyt. Chem., 76 (1929), No. 3–4, pp. 81–103*).—Essentially the method consists in the destruction of organic matter in a sample of the finely ground substance, weighed to contain from 10 to 100 mg. of arsenic, by treatment with from 2 to 3 cc. of 30 per cent hydrogen peroxide followed by from 5 to 10 cc. of concentrated sulfuric acid. This is an oxidation procedure said usually to give at once a colorless solution, after which the mixture is to be heated with a small flame for one minute after the appearance of white sulfuric acid fumes. Special precaution is prescribed in the case of the presence of halogens to be sure to use sufficient of the hydrogen peroxide to avoid loss of arsenic as trihalide.

Reduction to arsenious acid is effected by the addition of about 10 cg. of chlorine-free hydrazine sulfate, after which the solution is boiled free from sulfur dioxide (10 minutes vigorous boiling) and the arsenious acid is titrated with potassium bromate following the addition of 10 cg. of potassium bromide, the appearance of a yellow color being the end point. The solution is to be cooled thoroughly before titration.

A micro procedure, in which the sample is to contain from 0.5 to 10 mg. of arsenic, is also described in detail. Special modifications of the procedure adapting it for use with material containing the alkaline earth metals, iron, lead, mercury, or silver, are also described. The work in most of these cases consisted either in adapting current procedure to the convenient removal of

the metals in question or in demonstrating their noninterference with the arsenic determination.

Volumetric determination of arsine [trans. title], H. KUBINA (*Ztschr. Analyt. Chem., 76 (1929), No. 1-2, pp. 39-48, fig. 1*).—Small quantities of arsenic in the form of arsine could be determined accurately by oxidation with standard solutions of bromate or of iodine monochloride, followed by volumetric determination of the liberated bromine or iodine. The iodine monochloride reaction was found to possess the advantages over the bromate method that it did not involve difference methods and that it furnished a more rapid procedure.

The determination of sulphur dioxide in foods, G. W. MONIER-WILLIAMS (*[Gt. Brit.] Min. Health, Rpts. Pub. Health and Med. Subjs. No. 43 (1927), pp. V+56, fig. 1*).—This report comprises results of a somewhat extended study of the published work on sulfur dioxide and of a large number of experimental trials, and summarizes its conclusions with respect to the behavior of sulfur dioxide in foods and to the quantitative determination of the compound in food products in which it has been used as a preservative, as follows:

Sulfurous acid combines with aldehyde and ketone groups in foods, and to a smaller extent, possibly, with other groups. It is separated from combination rapidly on addition of alkali and more or less slowly on distillation with acid. Direct titration of foods or food extracts with iodine, after addition of alkali followed by acidification, may give fairly good results with some foods, but this is probably due in most cases to a balancing of errors. Distillation, according to one or other of the various modifications proposed, and with the necessary precautions against oxidation, is the only reliable method for the majority of foods.

Titration of the sulfur dioxide in the distillate, either as such or after oxidation to sulfuric acid, gives accurate results if precautions are taken to eliminate volatile organic compounds. Distillation in a current of carbon dioxide through a reflux condenser into pure hydrogen peroxide, and titration of the sulfuric acid formed, can be applied with satisfactory results to all foods.

With dried fruits the last traces of sulfur dioxide are given off with extreme slowness on boiling, even in strongly acid solution. Preliminary treatment of the food with sodium bicarbonate solution does not make any appreciable difference in the results.

Gravimetric determination as barium sulfate gives accurate results in nearly all cases. Bromine or iodine may be used as oxidizing agents, except when the distillate contains appreciable amounts of volatile sulfur compounds. In such cases oxidation with hydrogen peroxide and precipitation at room temperature with barium chloride permits of a sharp distinction between sulfur dioxide and other volatile sulfur compounds, including hydrogen sulfide. The amount of sulfur dioxide in foods decreases on keeping, the rate of decrease under the same conditions varying greatly with different foods.

A new rapid method for SO_2 in dried fruits, R. O. BROOKS (*Chemist-Analyst, 17 (1928), No. 1, p. 3*).—Under this procedure, force about 100 gm. of the sample through a finely adjusted meat grinder to obtain a practically lump-free paste. (If more than one sample is to be tested, use 150 gm. of subsequent samples and discard the first third of the paste.) Weigh out 50 gm. of the paste, break up into small lumps in a 600-cc. heavy, wide beaker (preferably of porcelain) and cover with about 100 cc. of distilled water. After the sugars are dissolved and the lumps of paste fall apart, macerate the wet paste with a clean wooden cylindrical pestle (potato masher) into a thin mixture, flattening out any lumps. Add 50 cc. of potassium hydrate solution (5.6 per cent), and macerate a few minutes longer with the wooden pestle. Scrape off the pestle

with a silver-plated table knife, wash the pestle well with a strong jet from a wash bottle and remove, stir up with the knife and similarly wash that, and after washing down the sides of the beaker, let stand at least 15 minutes. The total volume of alkaline fruit mixture should be about 300 cc. Finally add 20 cc. of sulfuric acid (practically free from SO_2) which has been diluted 1 to 3, quickly stir in with a rubber-tipped rod, then add about 2 cc. of fresh starch paste solution, and at once titrate with N/10 iodine solution until the contents of the beaker assume a greenish-blue color, which persists 5 minutes after vigorous stirring. (If a gelatinization of the mixture occurs after adding the 20 cc. of dilute sulfuric acid, add more water to liquefy it.)

The number of cubic centimeters of N/10 iodine solution multiplied by 0.0032 and the result again multiplied by 20 shows the milligrams of SO_2 per kilogram of dried fruits (or parts per million of SO_2).

METEOROLOGY

Temperature, sunshine, and wind, J. B. Kincer (*U. S. Dept. Agr., Atlas Amer. Agr., pt. 2, Sect. B (1928), pp. 34, figs. 111*).—This section of the Atlas of American Agriculture, prepared under the supervision of O. E. Baker, contains a selected list of references to the subject and maps, graphs, and descriptive notes based on records of cooperative observers of the Weather Bureau, located for the most part in the open country or small towns of the United States. There is shown among other things the annual march, seasonal, monthly, and daily averages, and ranges of temperature; possible and actual sunshine; and velocity and prevailing direction of wind for different parts of the country. Other sections of this atlas relating to climate, previously noted, are Frost and the Growing Season (E. S. R., 40, p. 209) and Precipitation and Humidity (E. S. R., 49, p. 313).

Monthly Weather Review, [January–February, 1929] (*U. S. Mo. Weather Rev., 57 (1929), Nos. 1, pp. 41, pls. 14, figs. 6; 2, pp. 43–83, pls. 13, figs. 11*).—In addition to detailed summaries of meteorological and climatological data and weather conditions for January and February, 1929, and bibliographical information, notes, abstracts, and reviews, these numbers contain the following contributions:

No. 1.—Hourly Frequency and Intensity of Rainfall at New Orleans, La. (illus.), by W. F. McDonald (pp. 1–8); Meteorological Survey of Proposed Sites for the San Francisco Municipal Airport, by E. E. Eklund (pp. 8–11); Father E. Gherzi, S. J., on a Study of the Rainfall of China (illus.), by A. J. Henry (pp. 12–17); Rapid Decrease in Barometric Pressure Northwest of Storm Track on November 17, 1928, by W. S. Belden (pp. 17, 18); A Dense Smoke Cloud on January 3, 1929, at Washington, D. C. (illus.), by I. F. Hand (pp. 18, 19); Correlation Studies: Temperature in Eastern United States, by F. Groissmayr (pp. 20, 21); and Heavy Snowfall of January, 1929, at Dubuque, Iowa, by H. M. Wills (pp. 21, 22).

No. 2.—Tropical Cyclones of the Eastern North Pacific Ocean (illus.), by W. E. Hurd (pp. 43–49); Duration of Rainfall at Baltimore, Md. (illus.), by R. Nunn (pp. 50–52); A Simple Method of Measuring the Diffused Radiation of the Sky According to Zones (illus.), by N. N. Kalitin (pp. 52, 53), with discussion by H. H. Kimball (pp. 53, 54); Dorno on Daily, Yearly, and Secular Variations of the Solar Radiation at Davos, by H. H. Kimball (pp. 54–56); Summary of the Present State of Our Knowledge of the Distribution of Ozone in the Upper Atmosphere (illus.), by G. M. B. Dobson (pp. 56, 57); Fowle on Atmospheric Ozone: Its relation to Some Solar and Terrestrial Phenomena,

by H. H. Kimball (p. 58); Severe Winter in Europe, 1928–29, by C. F. Brooks and N. H. Bangs (pp. 58–60); The Steamship "Meteor" Survey of the Tropical and South Atlantic Ocean (illus.), by C. F. Brooks (pp. 60–63); and Editors of the Monthly Weather Review, by A. J. Henry (pp. 63, 64).

Meteorological observations, [March–April, 1929], C. I. Gunness and L. O. Jones (*Massachusetts Sta. Met. Ser. Buls. 483–484 (1929), pp. 4 each*).—The usual summaries and notes are given of observations at Amherst, Mass., during March and April, 1929.

SOILS—FERTILIZERS

Soil technology (*California Sta. Rpt. 1928, pp. 99–103*).—Following a summary progress report on the soil survey of the State, various soil investigations are briefly noted.

[*Soil development in the San Joaquin family of soils*].—The work by Fernandez and C. F. Shaw on the soils of the San Joaquin family has been completed and shows the successive stages in the development of these soils, from the extremely raw soil material of the Tujunga series through the Hanford, Greenfield, Ramona, and Placentia stages to the mature San Joaquin series. The iron content of the so-called iron hardpan was found not to be very high, the cementing materials being primarily silica and aluminum compounds.

[*Soil moisture relations*].—Soil mulch has been shown in somewhat more than a year of quantitative measurements materially to reduce the evaporation from a soil surface having a water table less than 4 ft. below.

In the case of a soil of high alkali content, maintenance of the water table at 6 to 8 ft. below the surface in 8-in. galvanized-iron tubes filled with the soil "showed that there was a total loss of 3.7 cm. by capillary rise and evaporation of water from the tubes which had a water table at 8 ft. and 21.5 cm. from those having the water table at 6 ft. This indicates that 8 ft. is very close to the maximum height to which capillary rise will take place in this soil. The distribution of moisture in the tubes was similar to that found in similar experiments using nonalkaline soils. The distribution of the alkali as measured by the bridge method showed a high concentration on the immediate surface, followed by a very low concentration (practically none) at 6 in. below the surface, and then a rapid increase to a point about 30 in. above the water table. From this point to the water table the alkali content was about constant."

[*Alkali reclamation*].—Reclamation experiments in progress at various points showed beneficial results with alfalfa from the use of sulfur plus manure or gypsum. The use of iron sulfate was very unsatisfactory.

[*Paper mulches and soil temperatures*].—Results in general quite similar to those already noted (E. S. R., 59, p. 717) are briefly described.

Soil survey of Lake County, Ohio, A. E. Taylor (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.], Ser. 1925, No. 3, pp. 54, fig. 1, map 1*).—Lake County, northeastern Ohio, includes 149,760 acres of undulating or gently rolling plains marked by "rather prominent, isolated hills and deep valleys with abrupt slopes." Drainage is provided mainly by the Chagrin and Grand Rivers flowing to Lake Erie.

Mahoning silty clay loam, 29.4 per cent of the total area of the county, is the most prominent in extent of the 37 types found in the survey here described and classified into 16 series. Lands not classified consist of small areas of muck, peat, and marsh, and 4.8 per cent of rough, broken land.

This survey was made in cooperation with the Ohio Experiment Station.

Soil survey of Sheboygan County, Wisconsin, W. J. GEIB ET AL. (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.], Ser. 1924, No. 18, pp. 45, fig. 1, map 1*).—Sheboygan County, east-central Wisconsin, contains 329,600 acres, borders on Lake Michigan, and possesses a surface relief ranging through level and rolling to hilly and irregular, together with a drainage system leading chiefly through the Sheboygan River to Lake Michigan.

The soils of Sheboygan County are classified as 22 series inclusive of 39 types, among which Bellefontaine silt loam, 25.1 per cent of the total area surveyed, and Kewaunee silty clay loam, 23.2 per cent, are assigned the largest aggregate areas. Rough broken land 0.3, and dunesand 0.3 per cent, constitute the only unclassified surface noted.

This survey was made in cooperation with the Wisconsin Geological and Natural History Survey and the University of Wisconsin College of Agriculture.

A new, simple, and rapid method for determining the moisture equivalent of soils, and the rôle of soil colloids on this moisture equivalent, G. J. BOUYOUCOS (*Soil Sci., 27 (1929), No. 3, pp. 233–241, fig. 1*).—The author of this communication from the Michigan Experiment Station proposes the determination of the moisture equivalent, or "comparative moisture-holding power of soils," by using suction in place of centrifugation, the water free to leave the thoroughly wetted sample of soil being drawn off by means of a Büchner funnel and common suction flask attached to the water aspirator. A thick moist cloth was laid over the top of the funnel while the suction was being applied to prevent direct evaporation and to premoisten the air to be drawn through the soil.

Data obtained by this procedure for 22 soils are given in comparison with the percentages of colloids and the water colloid ratio.

The author concludes that "the method is simple, rapid, accurate, reliable, and infinitely more available than the centrifugal method. The results obtained by this method show that there is a remarkably close relationship between the moisture equivalent and the colloidal content of soils as determined by the hydrometer method. There is, however, no relationship between coarse silt and sand and the moisture equivalent. It is shown that the moisture equivalent or comparative moisture-holding powers of the different soils can be indirectly determined by the hydrometer method. It is also shown that the hydrometer method may be used to obtain 'single-value' factors for summarizing the various physical properties of soils. The hydrometer method has inherently great possibilities for the study of soils."

The measurement of "suction forces" in soils, C. F. SHAW (*Soil Sci., 27 (1929), No. 2, pp. 111–115, figs. 2*).—This communication from the California Experiment Station is a study, based in part on the theoretical considerations involved and in part on experiments illustrative of the viewpoints of the author of the present paper, on methods such as that proposed by Joffe and McLean (E. S. R., 54, p. 417) for the determination of the force found to be exerted by soils in absorbing or imbibing water.

"The 'suction' force of soils, and indirectly the colloid content, can not be measured by the use of porous burned clay or porcelain cups, bulbs, or tubes, because these porous materials themselves have a high water-lifting or 'suction' force. The soil may serve to remove the moisture from the surface of the material and thus make possible a continuation of the process until the weight of the mercury lifted overcomes the tensile strength of the water column or the forces which hold the water in the pores of the 'cup' material. The soil, however, would not carry any of the weight, nor supply any of the 'suction' force. It would function essentially the same as though it were lifting water from a

free water surface and would develop a water content essentially the same as that of the capillary rise."

Repair of soil filter tubes, G. J. LARSINOS and A. B. BEAUMONT (*Soil Sci., 27 (1929), No. 3, p. 243, fig. 1*).—This is a contribution from the Massachusetts Experiment Station, the repair suggested being that of the fracture frequently occurring in Chamberland-Pasteur filter tubes at the juncture of the unglazed tube and the glazed nipple. This type of break was found to be mended quickly and effectively with a short piece of 20-mm. stout rubber tubing. The air pressure used in the filtration was found effectively to seal the tube against leakage. It is noted that a new tube costs about $2.65 and the repair about 5 cts., the mended tube being little liable to further breakage. A diagrammatic drawing illustrates the completed repair.

***The use of dextrine in the isolation and identification of* Azotobacter chroococcum,** C. E. SKINNER (*Soil Sci., 27 (1929), No. 3, pp. 245, 246*).—"The use of dextrin nitrate agar . . . not only facilitates the isolation of *A. chroococcum*, but also prevents one considering many strains as nonchromogenic. Many strains of *A. chroococcum* have been isolated in this way without the failures formerly encountered."

Relation of temperature to the amount of nitrogen in soils, H. JENNY (*Soil Sci., 27 (1929), No. 3, pp. 169–188, figs. 10*).—The author has established as a result of work previously noted (E. S. R., 60, p. 118) that in semiarid and semihumid regions in the United States the average nitrogen content of the soil increases to the extent of from two to three times for each 10° C. of fall in mean annual temperature. This result was shown to be substantially in agreement with an equation based upon the assumption that organic matter produced by vegetation and its destruction by microorganisms are determined by climatic conditions. He then proceeds in the present communication from the University of Missouri to present further material collected to support the results already secured, first noting that "after a simple S-shaped curve is assumed for the decomposition process in respect to temperature, and when only soils of similar humidity and similar natural vegetation are considered, the equation takes the form:

$$N=\frac{a}{1+e^{kt}} \qquad (A)$$

where N represents the total nitrogen content of the soil in per cent, t the mean annual temperature, and a, k, constants." In the present paper are discussed the five new curves yielded by data for humid prairie and humid timber soils, and for semihumid prairie, terrace, and bottom land soils.

"The nitrogen-temperature curves of these soil groups can all be described by the foregoing formula. In spite of this agreement, however, equation (A) represents no more than a first approximation of the true law. It may be considered as a working hypothesis leading to interesting and important practical results. Greater knowledge of the decomposition of organic matter with respect to temperature is needed, and more soil analyses from northern latitudes should be secured in order to determine the absolute validity of the equation."

Further conclusions are represented by the following statement: "In the semiarid, semihumid, and humid regions of the United States a correlation exists between the mean annual temperature and the average total nitrogen content of upland prairie and timber soils and of terrace and bottom land soils. The decrease of nitrogen with increase of temperature is exponential or, in other words, the logarithm of the nitrogen varies inversely to the temperature. Generally speaking, for every 10° decline in mean annual tempera-

ture, the average nitrogen content of the soil increases two to three times The carbon-nitrogen ratio of the soil organic matter seems to become narrower with increasing temperature."

Some effects of crude petroleum on nitrate production, seed germination, and growth, H. F. Murphy (*Soil Sci.*, 27 (*1929*), *No. 2, pp. 117–120*).—It is noted that the effect of crude petroleum upon soils may become important in oil field districts and along pipe lines where breaks may allow the crude petroleum to overflow the lands near by; also, the effect of the petroleum has a bearing on the matter of putting land again under agricultural production, following abandonment of oil pumping.

The experimental work is described in two sections, of which the first, dealing with nitrate production, indicated that "even a very small application [of crude petroleum] has a tendency to reduce nitrate formation. . . . The application of approximately 0.4 per cent of crude petroleum to the surface cut down the nitrates about one-half, whereas approximately 1 per cent of crude petroleum mixed with the soil practically checked nitrate formation."

The second section of the experimental work, concerned with the effect of the petroleum on the germination of wheat seed and on the growth of wheat, was carried out on 8.5-lb. samples of the soil placed in 1-gal. tins and treated with various quantities of petroleum applied (1) by pouring on the surface, (2) by pouring on the surface exposed by removing the upper 4 in. of soil, which was replaced after the addition of the petroleum, and (3) by mixing the petroleum with the surface 4 in. of the soil. The seed was planted about 1.5 in. deep on September 9.

"Crude petroleum, even in small amounts, generally delayed germination. The containers in which the seed did not germinate were examined on October 19, and it was found that all of the wheat kernels had rotted. Mixing the crude petroleum with the surface was noticeably detrimental to seed germination. Five hundred gal. of crude petroleum mixed with the surface 4 in. of soil reduced the stand 36 per cent compared with the check average on October 17. Twenty-five hundred gal. of crude petroleum applied to the surface gave only approximately 23 per cent of a total stand compared with the check average on October 17. A similar amount of crude petroleum applied 4 in. below the surface did not reduce the final stand on October 17. Mixing any of the larger applications of crude petroleum with the surface soil prevented germination of the seed. Five hundred gal. applied to the surface did not prevent germination but did delay it . . . slightly."

[Exchangeable bases and phosphate soluble in dilute acid as affected by cropping] (*California Sta. Rpt. 1928, p. 89*).—In 13 soils under experimental observation since 1915 a study of the replaceable base content and the phosphate soluble in dilute acid indicated a general tendency toward decrease in exchangeable potassium as a result of cropping. The potassium concentration in the soil solution underwent a concomitant decrease. Soil solution concentrations of calcium and of magnesium were also decreased, "but the percentage of these bases in the exchangeable form has not diminished.

"In many of the soils dilute acid-soluble phosphate has been decreased in amount as a result of cropping."

[Agricultural chemistry investigations] (*California Sta. Rpt. 1928, pp. 31, 32*).—Alkali soil reclamation experiments, to which reference has previously been made (E. S. R., 60, p. 318), and boron toxicity and base exchange investigations (E. S. R., 59, p. 708) are again reported upon. On the alkali soils, sulfur, iron sulfate, alum, or gypsum applications have given good alfalfa

yields and "the plats treated with these materials several years ago are now producing large yields," but "sulfur continues to give the most promising and economical results. . . . It becomes increasingly evident that this soil can be reclaimed by drainage and leaching without applying any material, but the profit will be greatly increased by the use of sulfur."

In connection with the boron investigations a boron distribution survey has been made in the soils used for citrus fruit and in the irrigation supplies of southern California, with the result that boron was found in toxic concentrations only in a very limited soil area. "The irrigation supply, however, in certain districts contains an excessive amount of boron. It has been found that the boron is slowly absorbed by citrus and walnut trees and the element gradually accumulated in the leaves, where a toxic concentration ultimately results. Normal citrus and walnut leaves when grown in California appear to contain approximately 50 p. p. m. of boron. When injured by boron the content in the leaves ranges from about 300 to as much as 1,500 p. p. m. One p. p. m. of boron in the irrigation supply will sooner or later produce severe injury. The boron-containing waters are chiefly derived from surface stream flow. In a few cases comparatively deep wells also contain an excess of boron."

In the base exchange studies reported it was found that 1,000 lbs. of sodium nitrate to the acre can induce such a base exchange in the soil as substantially to reduce soil permeability. Soluble potassium salts produce a similar effect, with the result that the potassium "becomes fixed near the surface."

The results of a special investigation distinctly indicated the active constituent of the natural clay bentonite as identical with the base exchange complex of soils.

[Soil investigations in Iowa] (*Iowa Sta. Rpt. 1928, pp. 15–18, 47, 48*).—Miscellaneous items of soil investigation work reported include the following:

Rock phosphate, superphosphate, and complete fertilizer compared.—In this test, carried on for a considerable number of years on a group of 43 experiment fields, average results for corn, oats, wheat, and clover under each of the three fertilizer treatments applied in conjunction with manure and limestone and in conjunction with crop residues and limestone are presented in tabular summary. The rock phosphate was applied at the rate of 1 ton to the acre once in each 4-year rotation, the superphosphate at 150 lbs. to the acre on three crops in each 4-year rotation, and the complete fertilizer at 200 lbs. to the acre. The corn averaged with the manure and limestone supplementary treatment 63.3 bu. an acre for the rock phosphate experiment, 63.9 bu. for the superphosphate experiment, and 63.8 bu. for the soil treated with 2–12–2 complete fertilizer. The corresponding yields of oats were 58.7, 61.5, and 62.2 bu.; of wheat 26.1, 27.3, and 26.5 bu.; and of clover 2.17, 2.39, and 2.36 tons an acre. When limestone and crop residues were applied as the supplementary treatment the yields were, in the same order, of corn 58.7, 59.0, and 59.5; of oats 55.6, 58.7, and 59.2; of wheat 23.2, 24.2, and 23.9 bu.; and of clover 2.03, 2.10, and 2.12 tons.

Methods of applying commercial fertilizers.—"In some seasons broadcasting seems preferable, while in other cases hill or row distribution is better." Broadcasting involves a separate operation and in addition necessitates disking, but "it is a safe method, however, and never leads to germination or growth injury." On the other hand, "usually smaller applications made in the hill give equal results to larger amounts that are broadcast. For small grains fertilizer attachments for the drills give very satisfactory results."

Production of artificial manures.—"Composting straw at threshing time with certain combinations of chemicals will produce, for use the succeeding spring, an artificial manure which resembles ordinary farm manure and will give very similar effects on crops and on soil conditions."

Tests with sodium nitrate.—In tests with corn, in "several cases increases in crop yields were secured which were as great or greater than those brought about by manure. In other fields manure was much more effective."

The inoculation of soybeans.—Three years' tests showed in general the best results with the soil-paste method. Differences between varieties were encountered.

Tests on "Soilvita."—No evidence of a biological value of this commercial culture was obtained in laboratory, greenhouse, and field tests with a large number of crops.

[*Fertilizers on Iowa peats*].—Corn yields from five fields on which were tested, against a check in each case, superphosphate, potassium chloride, and superphosphate with potassium chloride, are tabulated, together with the percentage of soft corn. The conclusion stated is that "the beneficial effects of superphosphate are definitely shown on corn in these results, and sometimes muriate of potash with the superphosphates is very much worth while." The tabulated data show the percentage of soft corn to have been reduced in the yields of three out of four fields as much by superphosphate alone as by superphosphate combined with potassium chloride. At West Bend, the check showing 95 per cent of soft corn, superphosphate increased the yield by 17.5 bu. and reduced the soft corn to 40 per cent, whereas superphosphate with potassium chloride increased the yield by 20.8 bu. over that of the check crop and reduced the soft corn to but 7 per cent.

Soil fertility experiments at Bedford (*Indiana Sta. Rpt. 1928, pp. 29, 30, fig. 1*).—The soil-fertility tests in progress at the Moses Fell Annex Farm are discussed briefly, the work having been very similar in result to that already noted (E. S. R., 57, p. 614).

[**Pasture fertilizer treatment and other fertilizer tests**] (*Indiana Sta. Rpt. 1928, pp. 31, 32, fig. 1*).—On the Jennings County Experiment Field, various tests upon which have previously been noted (E. S. R., 57, p. 714), the capacity for the pasturage of livestock has been increased almost 400 per cent. The most effective treatments were found to be 3 tons of ground limestone and 1,000 lbs. of 0–16–16 fertilizer. Other fertilizer tests of a general character are briefly discussed with statements of yields and profits.

Failures of oats on certain of the black silt loams of northeastern Indiana were considered to suggest a deficiency in the soluble manganese content of the soil. Pot experiments indicated that either the addition of soluble manganese salts or the use of ammonium sulfate to increase the soil acidity to a point at which the manganese content of the soil, insoluble at lower acidities, becomes available, will improve the growth of oats on Brookston silt loam.

The relation between concentrations of potassium in culture solutions and optimum plant growth, R. P. Bartholomew and G. Janssen (*Soil Sci., 27 (1929), No. 3, pp. 189–203, figs. 2*).—Noting that "if a knowledge of the minimum concentration of potassium required for the maximum growth of a plant could be combined with a knowledge of the concentration of potassium in the soil solution and the ability of the insoluble compounds to maintain that concentration, a good basis for potash fertilization could be established," the authors of this communication from the Arkansas Experiment Station present the results of experiments designed to answer the two questions (1) "What are the minimum concentrations of potassium essential for plant growth?" and (2) "Will plants assimilate more potassium than the amount required for optimum growth?"

Seed of oats, alfalfa, Hubam clover, cowpeas, soybeans, Sudan grass, and cotton were placed for germination in quartz sand containing little if any of

the soluble plant foods. When the plants were from 2 to 3 in. in height they were transferred to culture solutions, made to contain various concentrations of potassium and so adjusted with respect to the other nutrients that "potassium was the only element limiting plant growth, and any increase in the amount of dry matter produced by increasing the concentrations of potassium can be attributed only to the increase in the concentration of potassium."

Previous work on potassium minima by the authors of this paper (E. S. R., 58, p. 315) and by Parker and Pierre (E. S. R., 60, p. 121) is mentioned in comparison with the present work.

The results obtained indicated a considerable variation among the requirements of the different plants. Alfalfa and Hubam clover were able to make optimum growth in a solution containing but 0.5 part per million of potassium under the conditions established, whereas oats, cowpeas, soybeans, and cotton attained their best growth at a potassium concentration in the nutrient solution of 2 parts per million, and 3 parts per million of potassium were found to be necessary to the production of a similar result with the Sudan grass. All of the plants made good growth, however, at a potassium concentration of but 0.5 part per million, and the plants showed themselves able to absorb more potassium than was determined to be their optimum growth requirement.

"There was no relation between total potassium requirements of plants and the concentration necessary to produce optimum growth. For example, oats and cowpeas have a low and high total potassium requirement, respectively, and yet both needed a concentration of 2 p. p. m. of potassium to make optimum growth."

Minimum potassium level required by tomato plants grown in water cultures, E. S. Johnston and D. R. Hoagland (*Soil Sci., 27 (1929), No. 2, pp. 89–109, pls. 2*).—Attention is drawn to concentration and volume as two distinct characteristics of the plant nutrient solution. These two factors are considered in part analogous to the intensity and capacity factors of energy, the experiments on the potassium requirements of tomato plants described and illustrated in this contribution from the California and Maryland Experiment Stations having been based upon this viewpoint and its corollary demands with respect to experimental conditions.

"In order to determine the minimum concentration of a given element that will produce optimum growth, the volume of the solution or total supply should be sufficiently large that it will not become the limiting factor. With a newly devised flowing solution apparatus, experiments were undertaken to determine the minimum potassium level requirement of the tomato plant. Under the given experimental conditions, which were kept within a range for good growth, it was found that optimum growth was maintained at a potassium concentration of approximately 5 p. p. m. at the intake. The rate of flow for such a solution averaged 8 cc. per minute per plant. The plants were grown for a period of 45 days. In experiments where the initial potassium concentration of 3.7 p. p. m. was reduced to 0.7 p. p. m. or even to 1.4 p. p. m., actual analysis of the plants showed a marked decrease in potassium absorbed and a tendency toward increased calcium, magnesium, and phosphate absorption as compared with check plants. A characteristic spotting of leaves indicating 'potash hunger' is very marked in tomato plants grown in solutions in which the potassium concentration is maintained below a certain level. Attention is called to certain interesting relations between potassium concentrations and light values, as suggested by one of the experiments."

The plates show the form of apparatus used and the effect of "potash hunger" on the leaves of tomato plants.

Potash from industrial alcohol, L. B. Broughton, H. L. Marshall, and N. C. Thornton (*Maryland Sta. Bul. 300 (1928), pp. 37-61*).—This bulletin is concerned mainly with tests of the fertilizer properties of an ash known as "vegetable potash" obtained as a by-product in the manufacture of alcohol from Cuban molasses. The molasses having been fermented, the alcohol is removed by distillation, the residual "slop" is evaporated to a concentration of 50 per cent solids, and this liquid is sprayed into a combustion chamber where it is desiccated and burned, the ash collecting on the furnace hearth. This ash when collected and ground is the product sold, and is described as a dark, finely ground material containing nearly 35 per cent of water-soluble potassium, calculated as oxide, "40 per cent of which is in the form of sulfate, 40 per cent in the form of muriate, and from 10 to 20 per cent in the form of carbonate." In the analyses here detailed there were found also 1.69 per cent of citrate-soluble phosphorus, calculated as phosphoric anhydride, and 0.36 per cent of nitrogen calculated as ammonia.

The tests made to ascertain the possibilities of vegetable potash as a fertilizer consisted in chemical studies of its effect on other constituents when used in fertilizer mixtures and in plat and field tests of the new product in comparison with other sources of potassium. In the course of three years' tests on tomatoes, white and sweet potatoes, and tobacco, the yields were better when vegetable potash was used as source of potassium than when others of the usual potassium compounds were applied. Wheat, on the other hand, gave no better results with the new source than with the usual sources of potassium

The alkalinity of the vegetable potash was found high, however, so that "large quantities of the product as a potash carrier can not be used in a fertilizer mixture, due to the loss of phosphorus by reversion and loss of nitrogen from ammonium sulfate." This difficulty could apparently be overcome, however, at least in some measure, since "storage studies on a 5-8-5 mixture compounded from 'uncut' superphosphate, muriate of potash, 'vegetable potash,' ammonium sulfate, and nitrate of soda indicate that a manufacturer can, dependent upon the initial acidity of the superphosphate employed, derive from one-fourth to one-half of the potash content of a fertilizer from 'vegetable potash' without a loss of phosphorus by reversion. . . .

"By deriving one-third of the ammonia content of a 5-8-5 fertilizer mixture from tankage, the remainder from ammonium sulfate or nitrate of soda, phosphorus from superphosphate, and potash from 'vegetable potash,' laboratory experiments showed that there was no loss of ammonia from ammonium sulfate and likewise no loss of phosphorus by reversion when the total five units of potash were derived from the alkaline residue. The stabilizing effect of the tankage used in these mixtures appears to be due to its dry flocculent nature effecting a separation of the acid and alkali particles, thereby producing a stable mixture."

Determination of the fineness of marl, E. P. Deatrick and C. Dorman (*Soil Sci., 27 (1929), No. 2, pp. 121, 122*).—It is noted that the accuracy of the standard method of determining the fineness of commercial preparations of marl has been questioned both by certain of the marl producers and by some control chemists, and experimental data upholding the opinion that the screening of the dry marl does not give accurate results are presented.

"By screening the marl after it is deflocculated, it has been found . . . that the material is really very much finer than the dry screening test would indicate. The amount of material passing a 0.1-mm. screen is in some cases 70 per cent greater after deflocculation. The deflocculation is conveniently accomplished by placing the dry marl (in this case 10 gm.) in a motor drink mixer as

modified by Bouyoucos [E. S. R., 57, p. 710], and allowing it to run for 9 minutes (the time required to deflocculate completely most soils) after 500 cc. of water and 5 cc. of N/10 KOH have been added. After the samples were deflocculated, the suspensions were poured through a battery of soil sieves of 1-, 0.5-, 0.25-, and 0.1-mm. mesh."

Inspection of agricultural lime products for the season of 1928, H. D. Haskins and M. W. Goodwin (*Massachusetts Sta. Control Ser. Bul. 46 (1928), pp. 7*).—Hydrated, precipitated, and ground shell limes, ground limestone, and lime ashes aggregating 27 registered brands were examined for calcium and magnesium oxides, but very few deficiencies in either of the oxides not made up by overrun in the other were found. Mechanical analyses are also reported in the case of limestones and shell limes. Cost per 100 lbs. of the effective oxides and other purchasers' information are included, together with analyses of two land plasters.

AGRICULTURAL BOTANY

Plant physiology (*California Sta. Rpt. 1928, pp. 44–56*).—No differences were found in the ash of normal citrus leaves of the same age that could be attributed to varieties or species. However, the water-soluble fractions of the dry matter of orange leaves were found to be greater than of lemon leaves. Sunlight was found to cause changes in the concentration of cell sap, leaves from the south side of the trees showing a higher concentration of sap than those on the shaded side. This is believed to indicate greater photosynthetic activity.

Studies of palisade tissues in citrus leaves showed that the ratio of the thickness of the palisade layer to the thickness of the leaf was nearly constant for any species or variety.

The translocation of water from the twigs into citrus fruits was investigated, and much of the water was found to move through the hydrophilic layers of pectin material in the cell walls, as well as by osmosis through the cells. Poisonous substances were absorbed as readily as others of equal molecular concentration, indicating that the process was not dependent on living cells.

The injection of iron salt solutions into chlorotic trees is said to have given temporary relief. The tissues above and below the point of injection were killed for some distance, indicating that the same hole can not be used for subsequent injections.

Some evidence was gained that is believed to show that rosette, little leaf, and yellows are related to the nature and amount of bases in the soil. Sap from diseased walnut branches was higher in calcium than that from healthy ones.

It is claimed that the existence of an axial gradient of growth in lemon trees is shown by the regular arrangement of shoots on the parent branch. The successive cycles of growth are assumed to be due to periodic activity of a specific growth-promoting substance.

A cytological study of water-soluble and fat-soluble constituents of citrus, J. Dufrenoy (*Jour. Agr. Research [U. S.], 38 (1929), No. 8, pp. 411–429, figs. 21*).—The results are given of a study of constituents of citrus in order to get a clearer notion of the biochemical changes taking place in the normal citrus tree, and resulting in the production of highly attractive fruit, and to learn the undesirable biochemical phenomena associated with pathological conditions or blemishes.

Cells of green parts of citrus leaves or fruits were found normally to contain one large vacuole, which could be readily stained in the living cell. Gentle excitations tended to cause the vacuole to break into a number of smaller ones.

It is said that greater shock may result in the browning of the vacuolar content and ultimately in the collapse of the cell. When this occurs the vacuolar material is thrown out of colloidal states and mixed with the cytoplasmic constituents, on which it exercises a coagulating effect. Cells of green parts of citrus were found to contain in their cytoplasm short rodlike mitochondria and starch-forming chloroplasts.

A number of conditions were found to result in the breaking down of the lipoprotein complex of which the normal mitochondria and plastids are made, resulting in such cytological phenomena as are naturally observed in the leaf tissues affected by frenching, or such as may be experimentally induced in the peel of the fruit by the ethylene-gas treatment for artificial coloring. The natural coloring process of the fruit was found to be associated with starch translocation from the chloroplasts in the cells of the three upper layers in the peel. As the starch disappeared, fat bodies were found to develop in the chloroplasts, and the orange pigment that gives the fruit its color went into solution in the fat bodies inside the chloroplasts. It is said that the same result can be obtained artificially through gas treatment.

Translocation of fats as such in germinating fatty seeds, J. B. RHINE (*Bot. Gaz., 82 (1926), No. 2, pp. 154–169*).—It was found that liquid fats would rise in the intercellular spaces of etiolated pea seedlings and would enter the cell. Neutral fats rose more rapidly than free acids in certain oils and passed into the cells from the intercellular spaces. It was shown that the fat intake was due exclusively to a water deficit in the walls of the starved etiolated pea seedlings in contact with unsaturated air. The view that endosperms of fatty seeds do not contain sugar during germination was found to be incorrect. The presence of oils of similar constitution in the new tissue as in the old is argued to be without significance in this connection. The theory that soaplike linkages form and aid in fat movement is claimed to be untenable in view of the pH values found in the seedlings. The existence of soaps in the cell is regarded as very unlikely.

By means of determining the respiratory quotients on hypocotyls of fatty and of starchy seeds during germination, evidence was obtained that the fatty seed hypocotyls were being furnished carbon in the same state of reduction as were those of the starchy seeds, and the inference is that that form could not be fat. If fats were to move as such, a gradient of decreasing concentration might be found in the region of most active growth, but the contrary condition was found to be the case. An examination of cell walls for fats in the course of transmission afforded no evidence of such movement.

"All evidence in favor of fat movement in plants that has been considered and reinvestigated has been found incorrect in fact or interpretation. The further evidence bearing on the problem, presented in this paper, favors the view that all the fat stored in the fatty seed is, as we have known most of it to be, first converted to sugars before being transported."

Effect of certain deficiencies on nitrogen metabolism of plants, R. C. BURRELL (*Bot. Gaz., 82 (1926), No. 3, pp. 320–328*).—In these preliminary experiments, employing Peking soybeans and Connecticut Field pumpkins because of their favorable growth rate and thriftiness under greenhouse conditions, the use of deficient nutrient solutions for studying processes concerned in plant metabolism was shown to have considerable possibilities. The hypothesis that certain elements play important rôles in different stages of synthesis occurring in plants was confirmed. It is claimed that, when a marked deficiency of a certain essential element exists, such a process as protein synthesis may be greatly retarded at a certain stage. An abnormal accumulation of

some intermediate product results, and the products characteristic of the later stages of the synthesis are formed in abnormally small quantities.

Influence of mineral elements upon development of chloroplast pigments of soy beans, C. G. DEUBER (*Bot. Gaz., 82 (1926), No. 2, pp. 132–153, figs. 5*).—In studies on soybeans grown in nutrient solutions with varying percentages of iron, potassium, and sulfur, ferric citrate proved to be throughout any given experiment from 4 to 13 times as efficient as ferrous sulfate, small additions of iron corresponding to considerable increases in growth.

Iron deficiency developed small black spots in the chlorotic new leaves. Potassium deficiency stunted growth markedly, but wide percentage ranges did not proportionately vary growth. The sulfur content influenced growth slightly. Acetone extracts of the total pigments of leaves are not considered safe criteria for judging the relative chloroplast pigment development, but ether extracts of the chloroplast pigments freed from water-soluble pigments are more satisfactory. Estimation colorimetrically of chlorophyll (*a* and *b*) against a standard of purified chlorophyll (*a* and *b*) in alcohol proved to be a satisfactory method.

The lack of iron or potassium in the nutrient solution gave a more marked depression of the chloroplast pigments than a lack of sulfur, though in general the chloroplast pigments increased with the increasing concentrations of iron and sulfur. In all the experiments the chlorophylls (*a* and *b*) and carotinoids were influenced to about the same extent by the composition of the nutrient solution. No strictly proportional relation could be established between the concentration or amount of any of the elements studied and the amount of pigment formed. A correlation betwen the green weight of the plants and the chlorophyll (*a* and *b*) was found in one experiment with iron, but this did not apply in the other experiments.

The expression of optimal light utilization in leaf structure [trans. title], E. HOFMANN (*Bot. Arch., 18 (1927), No. 4, pp. 288–296, figs. 2; Eng. abs., p. 296*).—Comparative study of mesophyll development in plants situated similarly except with relation to light incidence is said to show a mesophyll development 77 per cent greater in strong light than in a shady situation. The palisade cells show more rows and greater length. The cells of the spongy parenchyma are more numerous. The epidermis is thickened.

Illumination shows less influence on the vascular bundles, which develop only about 26 per cent more substance under illumination. The increase in the shadow is due principally to an increase in mechanical elements.

The development in the size of the epidermal cells is inversely proportional to the light absorption. The coefficient of enlargement of the epidermal cells under a set of conditions in shade is comparable to that of the enlargement of the leaf as a whole. Regarding the influence of light in comparison with shade as expressed in the increase of stomata, this appears to be only about 1 per cent.

Effect of light intensity on growth of soy beans and its relation to the autocatalyst theory of growth, H. W. POPP (*Bot. Gaz., 82 (1926), No. 3, pp. 306–319, figs. 8*).—In view of the fact that the Peking variety of soybean grown in light-lacking waves of the violet-blue range lengthened and twined excessively, while plants under the same total intensity of light having all the wave lengths of the solar spectrum gave no such response, the present study was instituted to determine whether similar effects could be produced by decreased intensity alone, the plants receiving all rays of the spectrum at greatly lowered intensities. Four varieties of soybeans were grown under six different intensities, averaging 4,285, 1,536, 560, 390, 250, and 26 foot-candles, respectively.

was found that the lower the light intensity, the more rapid the stem gation during the initial period of growth. The greatest range of height attained by plants under a light intensity averaging 560 foot-candles, and the est under an average of 26 foot-candles. Stem thickness was directly propor-ial to the light intensity, being greatest under 4,285 foot-candles and least ler 26 foot-candles. All of the plants were unusually long stemmed. Those eiving most light showed the greatest vigor and the best leaves, color, and it. A gradual falling off in these respects corresponded to a decrease in light ensity. Plants under 26 foot-candles became completely etiolated and died in m 3 to 4 weeks.

Twining occurred in all plants under light intensities from 250 to 1,536 foot-ndles, but not over 4,285 foot-candles or under 26 foot-candles. In soybeans latent factor for twining appears to be associated with stem length and thick-ss. Thick stems require a greater length for twining than thin ones, but in no se did twining occur in a stem less than 35 cm. (13.8 in.) high.

"The curves of growth in length of all plants except those in the darkest com-artment followed the general curve of a monomolecular autocatalytic reaction. he autokinetic phase of the curves appeared to be associated with the initia-ion and development of independence in the seedling brought about by the scendency of photosynthesis, while the falling off in rate during the latter art of the autostatic phase was caused by the development of flowering and ruiting."

Legume inoculation as influenced by stock and scion, T. E. Richmond (*Bot. Gaz., 82 (1926), No. 4, pp. 438–442, figs. 2*).—The two facts that the nodule bacteria of *Phaseolus lunatus* are distinct from those of *P. vulgaris* (supposedly the first recorded case in which the species of a legume genus are not all inoculated by the same nodule organism) and that it is possible to grow to maturity a Lima bean top on a navy bean root or a navy bean top on a Lima bean root are supposed to condition an advantageous method for studying the relation of legume hosts to their nodule-producing bacteria. Suggested questions are listed, and studies growing out of these are outlined with their results.

"When a Lima bean top is growing upon a navy bean root in quartz sand, a pure culture of Lima bean bacteria will not cause the formation of nodules upon the roots of the grafted plant, but the roots are stimulated, the plant grows to maturity, and appears to be able to obtain atmospheric nitrogen. When such a graft is inoculated with a navy bean culture, nodules are formed and the plant grows to maturity. The navy bean organisms in the roots apparently are able to furnish nitrogenous compounds to the Lima bean tops in exchange for carbohydrates synthesized by a top not normal to the nodule organism used. Similar results are obtained with the reciprocal grafts and inoculations. A Lima bean top grafted upon an inoculated navy bean root grew to maturity and developed seeds. When seeds are produced by a grafted plant, either Lima or navy, they are so modified that plants grown from such seeds no longer have the power of selective adaptation for the specific nodule organism common to it, but are inoculated by either the Lima or navy bean organism."

Meristems, O. Schüepp (*Handbuch der Pflanzenanatomie,* herausg. von K. Linsbauer. *I. Abt., 2. Teil, Histologie. IV, Meristeme. Berlin: Borntraeger Bros., 1926, pp. VI+114, figs. 42*).—In the present systematic account the meristems are dealt with primarily from the standpoint of development as regards elements and end results.

Plant material introduced by the Office of Foreign Plant Introduction, Bureau of Plant Industry, July 1 to September 30, 1926 (*U. S. Dept. Agr. Inventory 88 (1929), pp. 52*).—Descriptive notes are given of about 1,100 lots of seeds and plants introduced for testing in the United States.

The significance of serum diagnosis for research in the history of descent [trans. title], G. Mez (*Bot. Arch., 16 (1926), No. 1–6, pp. 1–23*).—This account outlines the theoretical basis and the methods of experimental systematization, giving an account of such work at the Königsberg Botanical Institute.

GENETICS

[Genetic investigations at the California Station] (*California Sta. Rpt. 1928, pp. 38–40, 80–84, 104, 105, 106*).—In genetic studies conducted at the Citrus Experiment Station M. M. Lesley found in a tetraploid seedling tomato that in the late prophase and first metaphase most of the chromosomes are associated in groups of four. Attempts to cross tetraploid and diploid forms were unsuccessful. A paper on this subject was recently noted (E. S. R., 59, p. 725). Resistance to delayed foliation was observed in peach seedlings bred by E. B. Babcock and others and differences in the degree of susceptibility to this condition were observed in commercial varieties. Observing that budded seedling citrus trees became noticeably less thorny with advancing age, especially in the new growth of the upper branches, propagations were made, with the result that often, but not always, the new nursery trees were less thorny than the originals. A third case of triploidy was found among hybrids between diploid citrus species. Tetraploid forms of apogamic origin were observed to generally produce notably fewer seeds than did diploid forms of the same variety. The tetraploid Lisbon lemon was, however, an exception. Differences in pollen production were observed in seedlings produced apogamically from a pollenless Navel orange and from a supposed Washington Navel orange. Genetic differences in pollen abundance are believed to occur on the same tree, suggesting the presence of a mutated gene with heterogeneous elements. Work with the garden stock Matthiola was continued. Tetrasomic Large and Slender forms were observed to give many tetrasomic and trisomic progeny with a few normals. The Tetrasomic Slender form occasionally gave rise to a pentasomic plant with three extra chromosomal fragments.

Working with various species of Ficus, I. J. Condit found 26 diploid chromosomes in six species and 24 in one species. The chromosomes of the six species were similar in appearance but quite different from those of the 24 numbered individual. More than 1,200 fig seedlings were obtained as a result of 1927 breeding studies.

H. van Elden determined the diploid chromosome number in several species of Persea as 24.

Genetic investigations with Crepis by Babcock, [E. L.] Hollingshead, [J. L.] Collins, and M. Navashin, reported on, included taxonomic studies, cytologic study of species in relation to their classification, genetic and cytologic study of interspecific hybrids, and investigation of chromosomal variations. Results are noted.

The inheritance of egg weight in the domestic fowl, F. A. Hays (*Jour. Agr. Research [U. S.], 38 (1929), No. 9, pp. 511–519, figs. 6*).—In a study of the inheritance of egg weight at the Massachusetts Experiment Station, it was found that egg weight showed a marked increase in Rhode Island Red pullets from the time of laying the first egg up until March 1. It was also found that pullets must lay eggs averaging 52 gm. in weight for the month of November, 55 gm. for the month of December, or 52 gm. for the period from the first egg to January 1, if their eggs are to attain standard weight (56.7 gm.) by March 1. The number of eggs laid was also related to egg weight, a correlation of -0.3673 ± 0.0254 being observed between the number of eggs laid

January 1 and the mean weight of those eggs, from which it was calculated at those birds producing eggs averaging 52 gm. might be expected to lay 48.47 ggs during the period.

In a special study of the mode of inheritance of egg weight five sires having large number of daughters for which egg-weight records were available were lated with 18 dams for which the egg weights of 224 progenies were deterlined. An analysis of these data indicated that egg weight was largely determined by the action of two genes, one called *B* for large-egg size, and the other *A* for small-egg size, which was epistatic to *B*. Four phenotypes were indicated from the distribution of the egg weights up to January 1, with the supposed genotypic constitution of each as follows: *aabb*, *AAbb*, and *Aabb* 47 gm. or less; *AABb* and *AaBb* 48 to 49 gm.; *AABB* and *AaBB* 50 to 51 gm.; and *aaBB* and *aaBb* 52 gm. or over.

Egg weight was also considered to be subject to the effect of physiological and hereditary modifiers. The difficulty of obtaining large-egg weight with high production is suggested as due to possible linkage between factor *A* for small eggs and factors *E* or *E'* for early sexual maturity, or *I* or *I'* for high intensity.

The age of the albino mouse at normal sexual maturity, E. T. Engle and J. Rosasco (*Anat. Rec., 36 (1927), No. 4, pp. 383–388, fig. 1*).—The author found from the examination of 100 female mice that the first appearance of the vaginal orifice with the ensuing first oestrum ranged from the twenty-eighth to the forty-ninth day of age, with the median at 35 days of age. They ranged in weight from 10 to 16 gm.

FIELD CROPS

[Contributions to agronomy] (*Internatl. Cong. Plant Sci. [Ithaca, N. Y.], Proc., 1926, vol. 1, pp. 47–160, 167–173, pls. 3, figs. 13*).—Papers presented in the agronomic section of the International Congress of Plant Sciences in Ithaca, N. Y., in August, 1926, and set forth in these pages included Nature and Agriculture in Dry Regions of the Union of Soviet Socialistic Republics, by N. M. Tulaikov (pp. 47–51); Soil Acidity, Plant Growth, and Its Practical Application, by O. Arrhenius (pp. 53, 54); The Place of Statistics in the Interpretation of Experimental Results, by H. H. Love (pp. 55–58); The Bacteroid-Like Form and Immunity in Leguminous Plants, by C. Cappelletti (pp. 59, 60); Russian Field Crops in the United States (pp. 61–86) and Introduction of Cultivated Plants into the Union of Soviet Socialist Republics (Russia) (pp. 171–173), both by D. N. Borodin; Varietal, Cultural, and Seasonal Effects upon the Water Requirement of Crops, by T. A. Kiesselbach (pp. 87–105); Experimental Error in Field Plot Tests, by L. J. Stadler (pp. 107–127); The Relation Between Plant Growth and Water Table on Drained Peat Soil, by A. T. Kirssanoff (pp. 129–135); Breeding Disease Resistant Varieties of Crop Plants, by H. K. Hayes (pp. 137–148); Breeding Wheat for Disease Resistance by C. E. Leighty (pp. 149–153); The Development of Disease-Resistant Strains of Corn, by J. R. Holbert and J. G. Dickson (pp. 155–160); and The Origin of Cultivated Plants, by N. I. Vavilov (pp. 167–169).

[Agronomic work in California] (*California Sta. Rpt. 1928, pp. 52–56, 5 58*).—In further studies of grasses and legumes (E. S. R., 59, p. 726) P. B. Kennedy found that the bulbils of bulbous bluegrass (*Poa bulbosa*) scattered on ordinary fallow will germinate after the rains and produce growth from 1 to 2 ft. high by the next May or June. Analyses by B. A. Madson indicate that the crop is high in nutritive value. The basal bulbs can persist throug

out the long, hot summers, while the bulbils dropping from the inflorescence also remain dormant during the summer and germinate in the autumn. Bird grass or rough-stalked meadow grass (*P. trivialis*), a European bluegrass, has proved highly valuable for lawns subject to shade and is suggested for pasturage in the northern cooler counties of California, being readily eaten by stock. Sainfoin (*Onobrychis viciaefolia*), *Hedysarum coronarium*, the birdsfoot trefoils, and a new perennial legume, tedera (*Psoralea bituminosa*), had certain promising features.

In the control of lady's-sorrel (*Oxalis stricta*), a bad lawn weed immigrant from Europe, which may take over the entire lawn in a few years, spraying with a 10 per cent solution of sodium chlorate is advised. Before reseeding, the lawn area should be irrigated during warm weather to germinate the Oxalis seed in the top soil and the new plants observed treated with a 5 per cent solution of sodium chlorate. After 5 days the area may be prepared as customary for reseeding. The appearance of goat grass (*Aegilops triuncialis*), a new and dangerous grain field and range weed, is recorded.

Causes of and suggested remedies for the injurious after effects of sorghum have been described elsewhere by J. P. Conrad (E. S. R., 59, p. 135; 60, p. 434). At the Imperial Valley Substation, Madson and L. G. Goar found that the time of planting markedly influences the yield of grain produced by grain sorghums and also that varieties differ widely in response to different planting dates. All sorts yielded considerably higher when planted August 1 than when planted earlier. Sugar beets from the September 27 planting were uniform, of good marketable size, contained from 19.8 per cent of sugar in the juice, and had a purity of 83.2 per cent, while those from later plantings were not so desirable. Of the summer legumes well adapted to Imperial Valley conditions, guar appeared to be the best cover crop for heavy soils although of little forage value, whereas the mat and mung beans seemed better suited to intermediate or lighter types of soil and are valuable forage plants.

The Hopi Lima bean endures heat and drought and is said to resist mildew, pod borers, and bean weevil, but it is markedly heterozygous, varying in growth habit from distinctly bushy to very viny and in seed color from white to black. Inheritance studies in 10 families showed segregation in the ratio of three viny types to one bushy recessive. Color segregation was in the ratio of three colored to one white, and in crosses between the Robust (white) bean and the common pink bean the same ratio was obtained with white recessive.

In cereal investigations in cooperation with the U. S. Department of Agriculture, V. H. Florell reported that Vaughn C. I. No. 1367, a new smooth awned barley, led in yields for the fourth consecutive year, and Federation, White Federation, and Hard Federation continued among the highest yielding wheats. In a varietal-date of seeding test with wheat, barley, and oats sown at monthly intervals from December to March the earlier seeding dates, with some exceptions, gave the highest yields.

Breeding work with grain sorghums and wheat is noted briefly.

[Crop experiments in Indiana] (*Indiana Sta. Rpt. 1928, pp. 14, 15, 29, 30, 31, 64, 69*).—Purkof selections showed much better winter resistance than typical soft winter wheat varieties and were followed by Michikof.

On the Jennings County experiment field manured land produced 38 bu. of sound corn per acre, manured and limed land 54 bu., and land receiving manure, lime, and phosphate 75.5 bu., whereas other farms in the community produced very little marketable corn. Corn responded strikingly to row fertilization.

Fertility studies on the Moses Fell Annex Farm showed that 225 lbs. of 16 per cent superphosphate per acre applied to corn and 225 lbs. applied to wheat in a 4-year rotation costing $5.40 per acre has increased the yields of corn 17 bu., soybeans 5.8 bu., wheat 6.9 bu., and hay 1,175 lbs., valued at $35.64 per acre per rotation. Hybrid strains of Johnson County White corn, Purkof wheat, Minota oats, Mammoth winter rye, Dunfield soybeans, and Purdue No. 21 winter barley produced the highest yields in variety tests. Lime and a complete fertilizer increased the green forage of pasture from 3,933 lbs. per acre to 18,150 lbs.

Wheat responded to fertilizer at the Purdue-Vincennes Farm with yields rising from 12 to 25 bu. per acre. A spring application of 100 lbs. of ammonium sulfate or sodium nitrate gave an added increase of from 6 to 10 bu. per acre.

[Farm crops investigations in Iowa] (*Iowa Sta. Rpt. 1928, pp. 13–15, 28, 29, 50–54*).—Under the severe conditions encountered in the winter of 1927–28, Grimm, Canadian Variegated, and Hardigan led the alfalfas in winter hardiness. Seed from the Dakotas and Montana, less hardy than the variegated sorts, were the hardiest of the common strains, while Utah and Idaho seed seemed less resistant than seed from Kansas or Nebraska. Ioturk wheat appeared to be one of the most winter hardy wheats at the station, although surpassed in this regard by Minhardi and Minturki. Tests with smooth awned barleys are also noted.

When varieties of oats, winter wheat, and barley were harvested at 3-day intervals, beginning when the grain was in condition for the binder and continuing from 3 to 6 weeks, wide differences were indicated in different varieties in regard to the harvest period. Iobred wheat and Iowa 105 oats appeared to be particularly satisfactory for combine harvesting, whereas barley had a rather short harvest period and must be cut just after ripening to prevent loss from shattering. Most sorts of grain seemed to gain about 10 per cent in yield by standing in the field from the time they could be cut with the binder until the moisture content had dropped to about 15 per cent.

Storage tests showed that grain containing 15 per cent or less moisture could be "combined" satisfactorily without danger of heating. Combined grain was found to pass through two sweats, the first resembling that ordinarily taking place in the shock. Electric measuring apparatus indicated that if the temperature does not rise above 100° F. the grain will keep satisfactorily. Corn cribbed with a high moisture content dried out very slowly due to a relatively mild winter. Throughout the entire winter the temperature in the corn was at least 10° higher than the outside air, a condition conducive to considerable shrinkage.

Curing experiments with alfalfa hay showed that the leaves aid in drying the stems, being more effective in the windrow. Production of the best hay normally obtained by windrowing soon after cutting, may be hastened somewhat by partial drying in the swath before windrowing. Hay in large covered containers spoiled more easily than in open containers.

In corn improvement studies the average yield of 53 F_1 crosses between inbred lines from Four County White (a selected strain of Silver King) corn was 7.3 bu. per acre higher than that of the parent, Silver King. The highest cross yielded 22.9 bu. (or 43.7 per cent) more than Silver King. With yellow corn 383 F_1 crosses averaged 5.4 bu. more than the average of 13 varieties and only 3.6 bu. below the highest variety. The 70 double crosses averaged 1.3 below the highest variety (Krug), and the highest F_1 cross yielded 13.7 (23.7 per cent) more.

According to inheritance and linkage investigations with corn a new factor for aleurone color, apparently influencing both aleurone and plant color similarly to the *A a* factor, in contrast with *A a*, seems to have no influence on cob color. Linkage studies indicated that a factor for striped seedlings called iojap (E. S. R., 53, p. 29) is linked with ramosa. Factors for yellow seedlings include two previously reported factors, l_1 and l_2 (E. S. R., 55, p. 329), and two new factors, l_3 and l_4, one of which, l_4, appeared to be linked with l_1 and l_2. A type of ear which is much branded and sterile has been shown fairly definitely to depend upon a single factor in inheritance. A plant character in which the veins of the leaves appear longer than the surrounding tissue, causing a knotted condition, was fonnd to be governed by a single dominant factor. A type of lodging due to weak culms behaved as a simple recessive.

Comparative ranges of adaptation of species of cultivated grasses and legumes in Oklahoma, K. H. KLAGES (*Jour. Amer. Soc. Agron., 21 (1929), No. 2, pp. 201–223, figs. 7*).—The distribution of groups of forage crops in relation to the types of native vegetation of Oklahoma is discussed, and the factors favoring and limiting the distribution of the several groups are considered. The yields, ranges of adaptation, factors favoring, and factors limiting the growth and employment of 18 species of cultivated grasses and 14 species of legumes are reported from the results of comparative trials at the Oklahoma Experiment Station.

The rice, sugar cane, tobacco, and corn projects of the division of plant investigations of the Bureau of Agriculture, M. MANAS Y CRUZ and F. G. GALANG (*Philippine Agr. Rev., 22 (1929), No. 1, pp. 43–70*).—The principal experiments reviewed for various periods embraced breeding work and variety, fertilizer, and cultural (including planting) tests with the above crops; curing, irrigation, and seed viability studies with rice and tobacco; weed control and milling tests with rice; and observations on soils, climate, diseases, and insect pests.

The effect of barley manuring upon the following hay crop, H. FAIL (*Jour. Roy. Agr. Soc. England, 89 (1928), pp. 134–141, fig. 1*).—Combinations of ammonium sulfate, superphosphate, and potassium sulfate applied to barley (E. S. R., 59, p. 327) following swedes at the Norfolk Agricultural Station had various effects on the barley and also strikingly influenced the succeeding hay mixture.

Potassium had the greatest residual effect, visibly stimulating the clover in yield and in percentage. The phosphorus residue increased the hay yield, but the clover was not so vigorous as on the potassium plat. The yield of hay on the nitrogen plat was lower than on the untreated plat, due to the poorer growth of clover. Weeds decreased as the hay yield and proportion of clover increased.

Barley for Michigan farms (*Michigan Sta. Spec. Bul. 191 (1929), pp. 28, figs. 16*).—A practical discussion by H. C. Rather of the status of barley in Michigan, its yields, production costs, utilization, and cultural practices, is supplemented by an account by E. E. Down, H. M. Brown, and F. H. Clark of the merits of different barley varieties, as shown in tests at the station and in cooperative trials. Spartan, developed from a cross between Michigan Black Barbless and Michigan Two-Row barleys, is described as a smooth-awn, 2-rowed barley worthy of note in its yield, earliness, erect heads, sparse foliage, and stiff straw.

Multiple ear character in maize, C. K. MCCLELLAND and G. JANSSEN (*Jour. Heredity, 20 (1929), No. 3, pp. 105–109, figs. 3*).—Several lines of inbred Jarvis Golden Prolific corn under study at the Arkansas Experiment Station have been

acterized by multiple ears, from two to six or more, within a common husk. ...al inspection revealed that all of the ears within the husk had a normal cob, ... and macrogametophyte. This multiple ear type seems to be distinct from branched ear types described by Kempton (E. S. R., 50, p. 528).

...ecessive defects and yield in corn, J. B. WENTZ and S. F. GOODSELL (*Jour. ... Research* [*U. S.*], *38* (*1929*), *No. 9, pp. 505–510*).—The possibility of a ...ation between the number of heritable abnormalities or defects present in a ...mmercial corn variety and its yield was investigated at the Iowa Experiment ...tion.

The data from plantings of selfed lines of 19 varieties of corn indicated that ... statistically significant relation exists between numbers of defects present ...d yield. When the defects were classed as seed, seedling, and plant, it was ...served that the totals under each of the three classes, as well as the total ...r all defects, were correlated negatively with yield. This might indicate a ...ight deleterious effect of the groups of defects upon yield, but none of the ...rrelation coefficients were large enough to be considered significant.

The relation of shuck covering to ear-worm attack, C. K. MCCLELLAND ...*Jour. Amer. Soc. Agron.*, *21* (*1929*), *No. 2, pp. 235, 236*).—Observations at the ...rkansas Experiment Station in 1928 on open-pollinated ears of selfed strains ...f different corn varieties and also on open-pollinated ears of Paymaster corn ...howed that of 1,038 ears, 994, or 95.8 per cent, were entered by corn ear worm. ...f 279 ears with husk extension of 4 in. or longer, 261, or 93.5 per cent, were ...ntered. The data suggested that long husks offer little protection in a season ...f universal attack, although they protect against weevil, wet weather, and molds.

Cotton investigations in Batangas and the Ilocos Provinces, J. M. EJERCITO and P. I. CRUZ (*Philippine Agr. Rev.*, *22* (*1929*), *No. 1, pp. 23–37, figs. 7*).—Cultural methods are outlined and data given on production costs. Apparatus used in the native textile industry is illustrated.

Fall sown oats for Georgia, R. R. CHILDS (*Ga. Agr. Col. Bul. 355* (*1928*), *pp. 22, figs. 3*).—Experiments including variety, fertilizer, and cultural tests with fall-sown oats, in cooperation with the U. S. Department of Agriculture, have been noted extensively from another source (E. S. R., 57, p. 430).

Field peas in Wisconsin, E. J. DELWICHE (*Wisconsin Sta. Bul. 408* (*1929*), *pp. 16, figs. 10*).—Cultural and field methods, inoculation, harvesting practices, and classes of field peas are described for the production of the crop in the State.

Reed canary grass, A. C. ARNY, M. C. HANSEN, R. E. HODGSON, and G. H. NESOM (*Minnesota Sta. Bul. 252* (*1929*), *pp. 19, figs. 7*).—Reed canary grass (*Phalaris arundinacea*) has been found, especially in south central Minnesota, to fill a definite need for a high-yielding, nutritious hay and pasture crop on many comparatively small areas of low, poorly drained lands, mostly of a peaty nature. Information is given on its history, adaptation, plant and seed characteristics, cultural needs, use, feeding value, and seed production. Feeding tests in comparison with timothy, wild hay, and alfalfa hay for cows and the germination percentages and other data for seeds with varying amounts of color in their hulls are noted briefly.

The mechanical blocking of sugar beets, S. B. NUCKOLS (*Facts About Sugar*, *24* (*1929*), *No. 19, pp. 448, 449, fig. 1*).—A method designed to save hand labor and provide more regular spacing of blocks consists essentially of cross cultivation with a sugar beet cultivator with 6-in. knives set 10 in. apart on the tool bar. This arrangement cuts out six-tenths of the stand of beets and leaves 4-in. blocks of beets between the cut-out spaces. In a perfect stand this cross

cultivation leaves 120 blocks of beets to 100 ft. of row. The setting of a knife in direct line with each wheel prevents the leaving of any beets which are injured by the wheels of the cultivator. Cross cultivation or mechanical blocking should be done as soon as the beets have reached the four-leaf stage, but may be done when the beets are much larger.

Sugar-cane experiments in the Leeward Islands [1927–28], A. E. COLLENS ET AL. (*West Indies Imp. Dept. Agr., Leeward Isl. Sugar-cane Expts., 1927–28, pp. [2]+18*).—The tonnage, juice, and sucrose production are tabulated as heretofore (E. S. R., 59, p. 437) for sugarcane varieties and seedlings tested in comparison in Antigua and Montserrat during 1927–28. The suspension of the experiments is reported.

The sugarcane varieties of the 1928 and 1929 crops in Java [trans. title], A. VAN LEER (*Arch. Suikerindus. Nederland. Indië, Meded. Proefsta. Java-Suikerindus., 1929, No. 9, pp. 531–570*).—Sugarcane varieties in Java in order of importance in the 1928 crop were P. O. J. 2878, E. K. 28, D. I. 52, and other P. O. J. strains, occupying, respectively, 66.5, 13, 11.75, and 4.75 per cent of the total acreage planted to cane on the island. The estimates of the 1929 acreage are P. O. J. 2878 with 93 per cent, E. K. 28 with 2.5 per cent, D. I. 52 with 1.75 per cent, and other P. O. J. strains with 2 per cent.

Factors influencing the growth and sugar contents of cane, K. KRISHNAMURTHI RAO (*Agr. Jour. India, 24 (1929), No. 2, pp. 91–101, pls. 2*).—Meteorological conditions in the different sugarcane districts of the world and also soil conditions, especially in India, are discussed in regard to their effects on the growth and sugar content of sugarcane.

Symposium on "tobacco research," W. L. SLATE ET AL. (*Jour. Amer. Soc. Agron., 21 (1929), No. 2, pp. 113–167, figs. 20*).—The papers included in this symposium have been listed earlier (E. S. R., 60, p. 300).

Soil reaction studies on the Connecticut tobacco crop, P. J. ANDERSON (*Jour. Amer. Soc. Agron., 21 (1929), No. 2, pp. 156–158, fig. 1*).—Examination by the Connecticut Tobacco Substation of soils from fields throughout the tobacco-growing section of New England and the tobacco growing on these fields showed the maximum number to be in the range from pH 5 to 5.6, averaging 5.42. Soils as acid as 4.2 and above 7 were very rare. Good tobacco was never found on land testing as low as 4.2 and often it was poor up to 4.5. Evidently all tobacco soils should test at least above 4.5 for good growth, and, considering both yield and quality, the optimum reaction for tobacco soils is between pH 5 and 5.6. Root rot trouble begins in the range above 5.6, and from 5.6 to 6 is a doubtful zone. From pH 6 up it is a rule that the higher reaction is accompanied by worse root rot and poorer growth.

The vegetation of fallow tobacco land in Deli [trans. title], S. C. J. JOCHEMS (*Meded. Deli Proefsta. Medan, 2. ser., No. 59 [1928], pp. 95, pls. 24, figs. 2; Eng. abs., pp. 91, 92*).—In the Deli district, land is cropped in tobacco for one year, followed by one crop of dry rice, and then reverts to a secondary jungle consisting of a few trees with undergrowth of several species of shrubs and herbaceous plants and the whole interspersed with different kinds of climbers. The studies reported deal with the influence of this flora upon the tobacco crop as a soil improver and source of insect pests and diseases, and the composition of the flora in different stages of the fallow and in different situations.

The effect of other crops on tobacco, J. P. JONES (*Jour. Amer. Soc. Agron., 21 (1929), No. 2, pp. 118–129*).—Investigations by the U. S. Department of Agriculture in Maryland, Connecticut, and Massachusetts and by the Ohio, Connecticut, and Massachusetts Experiment Stations concerned with the effects

ther crops on tobacco are reviewed in this contribution from the Massachu-s Station.

ertain crops in rotation appeared to exert depressing effects on tobacco, ile others seemed to be indifferent. However, those producing notable reases in yield and quality were quite rare. The rotation of tobacco, eat, and red clover gave very satisfactory returns in Maryland and Ohio, ereas a similar rotation of tobacco, corn, and timothy or clover hay seriously creased the yield and quality of the tobacco in Massachusetts. The way fferent crops affected tobacco in different sections lacked in consistency. esults with cover crops resembled those where different crops are grown in tation. In some cases yield decreases accompanied the use of cover crops, hile in others yield was not affected. Cover crops did not give returns that ould justify their use.

Crop effects were found to be associated with brown root rot. In New ngland particularly, the most serious injury from previous crops has accom-anied severe brown root rot; where brown root rot was not severe crop effects ave been less marked. Brown root rot is discussed briefly in relation to the ause, nutritional conditions, and crop sequence.

Some factors affecting the nicotine content of tobacco, C. W. Bacon (*Jour. Amer. Soc. Agron., 21 (1929), No. 2, pp. 159–167, figs. 6*).—The nicotine content of tobacco depends on the type, plant part, cultural practice, maturity, and fertilizer treatment. The Maryland and Turkish types are low in nicotine; the flue-cured, Burley, Cuban, and Connecticut are medium; and the Pennsylvania, dark fire-cured, and especially *Nicotiana rustica* are high in nicotine content. The percentage in the leaf may be quite high and that in stalks and leaf stems low except in *N. rustica*. Topping and suckering greatly increased the nicotine content of *N. rustica*. The nicotine content progressively increased as tobacco matured, particularly in a high-nicotine strain. Heavy application of nitrogen (sodium nitrate) was followed by marked increase in nicotine content.

High-nicotine tobacco, R. C. Collison, J. D. Harlan, and L. R. Streeter (*New York State Sta. Bul. 562 (1929), pp. 19*).—Experiments on the culture of high-nicotine tobacco (*Nicotiana rustica* and varieties of *N. tabacum* fairly high in nicotine) are described, and the cultural requirements and uses of the crop in New York are outlined. The current observations in these studies have been noted (E. S. R., 58, p. 828).

The nicotine content has compared very well with similar tobacco grown in other humid regions, but both yields and nicotine content fall far below that of the same species grown under irrigation in the arid Southwest. Plant selection, fertilization, careful topping, and culture have raised the nicotine content to a certain extent but not strikingly. The seasonal factor also appeared to be important.

From the results of the inquiry, it did not seem practical for the New York fruit grower to grow his own tobacco with the expectation of using it for spray purposes.

Correlation studies with diverse strains of spring and winter wheats, with particular reference to inheritance of quality, H. K. Hayes, F. R. Immer, and C. H. Bailey (*Cereal Chem., 6 (1929), No. 2, pp. 85–96*).—Milling and baking tests were made at the Minnesota Experiment Station on strains of wheat obtained largely from purified hybrids selected from crosses. The wheat strains were grown in comparative rod-row trials, and a mixture of grain from four localities was made for each spring wheat sample and from two localities for each winter wheat sample.

Computation of interannual correlation coefficients for protein content, loaf volume, flour percentage, color score and texture score of loaf, and kernel texture showed a general tendency for a correlation between the results of different seasons when wheats of diverse nature were grown under comparable conditions. Neither protein content nor kernel texture was significantly and consistently related to loaf volume, and with wheats of diverse nature a significant positive relation between protein content and kernel texture was not apparent. There was some indication of a slight general tendency for a positive relation between loaf volume, color score of loaf, and texture score of loaf.

Effect of date of seeding of winter wheat upon some physiological changes of the plant during the winter season, G. JANSSEN (*Jour. Amer. Soc. Agron., 21 (1929), No. 2, pp. 168–200, figs. 11*).—The changes in the composition of the crown of the wheat seedling were studied at the University of Wisconsin during the winter seasons of 1923–24 and 1924–25. Seedings were made on or close to August 15, August 31, September 21, October 6, and October 19. The order of mortality due to winterkilling from high to low for three years, 1922 to 1925, was October 19, October 6, August 12, August 31, and September 21.

In general, a positive correlation was apparent between the total soluble carbohydrate compounds and better dates of seeding or winterhardiness for 1923. The September 21 or optimum seeding date showed in 1923, particularly, the greatest percentage of total sugars as well as total carbohydrate compounds. The total nitrogen compounds remained about the same throughout the winter, being somewhat higher in the young than in older plants. The water-soluble nitrogen and soluble nitrogen coagulable by heat rose during the autumn as the temperature decreased. The soluble nitrogen which is coagulable increased with the drop of the temperature to the freezing point, after which it greatly decreased. The percentage of water-soluble nitrogen which is coagulable was greatest for favorable seeding dates before the plants were frozen, but after freezing the coagulable nitrogen was much less for plants from favorable than from unfavorable seedings. Plants from the most favorable seeding dates had a greater capacity for changing the protein nitrogen from a precipitable to a nonprecipitable form.

Growth period of wheat, R. C. SCOTT (*Jour. Dept. Agr. So. Aust., 32 (1929), No. 8, pp. 717–720, 722*).—Records on wheat varieties taken over extended periods at Roseworthy Agricultural College showed that the period between germination and full bloom classifies varieties much more distinctly than that between germination and ripening of grain. Important wheats grown in South Australia are grouped as to maturity.

Seed inspection, P. H. SMITH, E. F. HOPKINS, O. W. KELLY, and C. L. BEANE (*Massachusetts Sta. Control Ser. Bul. 47 (1929), pp. 11*).—The results of the first inspection under the provisions of the seed law effective November 1, 1927, are noted briefly, the methods of testing seed are outlined, and comment is made on field trials of alfalfa, clover, and vegetable seeds for trueness to type. From November 1, 1927, to October 1, 1928, 240 official samples were tested. The text of the law is included.

Report of seed analyses, 1928, E. M. GRESS and M. C. MOWRY (*Penn. Dept. Agr. Bul. 470 (1929), pp. 74*).—Tables show the purity, germination, and weed seed content for 886 samples of agricultural seed collected during 1928.

HORTICULTURE

[Horticultural investigations at the California Station] (*California Sta. Rpt. 1928, pp. 35–37, 38, 67, 68, 93, 95, 96, 97, 103, 104, 105, 106, 107, 108, 111–113*).—The usual annual report (E. S. R., 59, p. 786).

t the Citrus Experiment Station fertilized trees were more vigorous and tful than the unfertilized. Three lbs. of nitrogen per tree was more effec- than was 1 lb. Studies of the nitrate nitrogen movement in the soils he various plats failed to show any significant differences. There was a sistent concentration of nitrates in the upper 6 in. and seldom more than m 10 to 15 parts per million in the root zone (6 to 36 in.). Natural rain- l was the principal factor in the movement of nitrates below the surface lch. Unless fertilizers were applied at the time of irrigation and placed ectly in the furrow the water had little influence on nitrate movement.

The prompt harvesting and curing of walnuts was found important in pre- nting the development of dark colored kernels. Commercial bleaching uors were found as effective but slightly more expensive than chloride of me. The greater cost, however, was offset by their greater utility. Insuf- cient irrigation water early in the season resulted in a marked reduction the size of walnuts and in late summer in improper development of the ernels.

Propagation studies with citrus showed quite conclusively that the variant ff-type seedlings almost always result in small orchard trees. Washington Navel and Valencia oranges, Eureka and Lisbon lemons, and Marsh grapefruit were compared on various selected rootstocks. The Sampson tangelo gave promise of being an excellent juice fruit.

Studies in lettuce seed germination are again reviewed (E. S. R., 59, p. 634).

Attempts to establish the cause of poor germination in carrot seed led to the conclusion that umbels developing late in the season do not produce as good seed as do the earlier umbels. The central umbellets produce better seed than the outer ones.

Pomological investigations included a study by L. D. Davis of the chemical changes occurring in bearing and nonbearing sugar prune trees and included the effect of disbudding bearing limbs. Starch was found consistently higher in the nonbearing trees. Nitrogen was higher in the bearing trees until about May 1 and lower during the rest of the season. Reducing substances were lower in the bearing trees until May 1 and then higher as the season advanced.

Further studies by M. J. Heppner of black end of pear substantiated earlier conclusions, namely, that this condition is associated with the rootstock. Inarching with French pear seedlings is suggested as a promising means of control.

Several thousand peach seedlings were planted by W. L. Howard and Heppner in an attempt to discover nematode-resistant stocks. The Marianna plum, resistant to nematodes, was not found a good peach stock.

Studies were made by O. Lilleland of the carbohydrate changes in peach, plum, and apricot kernels throughout development. In the peach late thinning was found as effective as early thinning in causing the fruits to enlarge.

E. L. Overholser and B. D. Moses found that boxed pears in warehouse precoolers could be cooled from approximately 75° to 33° F. in 45 hours when the temperature of the storage was held at 32°. Under like conditions grapes were cooled from 60° to 33° in 44 hours and oranges from 74° to 35° in 64 hours. Records are also given for tests in car precoolers.

Following the changes in pH, Ca, K, Mg, NO_3, SO_4, and PO_4 ions in a series of 28 plats, E. L. Proebsting found marked differences according to the crops grown. The concentration of nitrate was much higher in plats of pears than of peaches. Nitrate was consistently low in plats cropped permanently with alfalfa. Sulfate concentration was higher under peaches than under pears.

Most ions were at a minimum in spring and a maximum in late summer or fall. In fertilizer studies no response was found to potassium, either in respect to yield or sugar content of prunes or in the percentage of split pits in the peach. On a light soil peaches responded favorably to applications of nitrate.

F. G. Anderssen, studying the tracheal sap of pear and apricot trees, found marked seasonal variations in composition. That wounding in the dormant season may affect the starch content of the pear tree was noted by A. H. Elsawy, who found a marked depletion manifested as far as 3-ft. distances from the cut. F. E. Gardner found that pear branches exposed to temperatures slightly above freezing for from 2 to 3 months during the dormant season had an increased concentration of soluble constituents in the branches and grew readily on removal to a favorable environment, whereas branches held in a warm greenhouse showed only slight changes and failed to grow.

Studies by S. H. Cameron upon the composition of young orange trees showed in general a maximum starch content in early spring coincident with a minimum moisture content and a minimum starch content in late summer in connection with a maximum moisture content. These changes were most marked in the root bark. Fluctuations in the sucrose-free reducing substances and benzene soluble constituents were very slight. Free reducing substances precipitable with mercuric nitrate accounted for from 50 to almost 100 per cent of the total free reducing substances calculated as glucose.

R. W. Hodgson and S. S. Shady studying the effect of heat on the ripening of citrus fruits found that the Valencia orange has apparently the highest heat requirements, Navel orange the lowest, and the Marsh grapefruit intermediate, as expressed in the terms of the number of Fahrenheit degrees above 50 during the period between full bloom and harvest.

Progress was made by I. J. Condit in clearing up the confused nomenclature of the fig. Studies conducted near Merced by Cameron and Condit on the hardiness of figs made little progress on account of the absence of low temperature. As compared with heading, long pruning of the Kadota fig resulted in larger yields and earlier maturity.

Severe pruning of the Sevillano olive greatly reduced yields. No significant differences were found by Cameron in the sugar content of Deglet Noor dates taken from potassium and no-potassium plats. A. R. Gee, working with Cameron, found evidence that the starch cycle in the avocado and olive conforms to that of citrus, while in the walnut, persimmon, and fig the cycle resembles that of deciduous trees.

Asparagus investigations again constituted an important phase of the truck crop investigations. Male plants outyielded female by about 50 per cent, but produced a larger percentage of small grades. Mary Washington is considered the best variety from the standpoint of quality. From 7° to 12° C. was found a suitable storage temperature for mother bulbs of the onion. Endive was found capable of self-fertilization. Several noncommercial varieties of melons immune to powdery mildew were discovered. Studies in melon ripening are again reviewed (E. S. R., 60, p. 339).

Grape-breeding studies conducted by F. T. Bioletti and E. B. Babcock resulted in a large number of seedlings in which Muscat of Alexandria figures prominently as a parent.

A. J. Winkler extended his studies of light pruning accompanied by blossom thinning to 34 additional varieties of grapes. This practice improved the fruiting of such varieties as Muscat of Alexandria and Hunisa, both in respect to the weight of the cluster and the number and percentage of normal berries per cluster. Improvement with Malaga, and comparable varieties which set well with spur pruning was not so marked.

Pruning studies conducted by Bioletti with rooted cuttings prior to planting showed that (1) little pruning results in increased growth, (2) root pruning is more repressive than top pruning, (3) pruning both top and roots is less repressive than root pruning alone, and (4) the coefficient of correlation between size of rootings and subsequent growth is not great, the largest, 0.459, occurring where no pruning was done with roots in good condition and 0.132 with both roots and tops pruned with roots in poor condition. With roots alone pruned the correlations were negative, —0.299 and —0.304 for good and poor roots, respectively. Rooted plants in good condition suffered materially less from root pruning alone than did comparable plants in poor condition.

Girdling experiments conducted by H. E. Jacob with three varieties of seedless grapes, Black Corinth, Monukka, and Sultanina, showed decided increase in berry size in most cases. In Black Corinth and Monukka girdling gave increases in all cases, attaining a maximum of 201 per cent in Black Corinth with vines girdled in full bloom. The maximum in Monukka was 49 per cent in vines girdled at the end of bloom. In Sultanina only those vines girdled at the stages, end of bloom, berries set, and berries one-fourth grown, showed increased size, the maximum, 21 per cent, being in the last case. The quantity of fruit was increased in all lots except Sultanina girdled at the beginning of bloom, and since this increase was greater than that of berry size it is concluded that the number of berries was also increased. The length of the clusters was not appreciably affected. No effect on the time of ripening was noted. Girdling the trunks of Black Corinth and Sultanina almost invariably gave better results than girdling the canes.

[**Horticultural investigations at the Indiana Station**] (*Indiana Sta. Rpt. 1928, pp. 50, 51, 52, 53, 60, 65, figs. 2*).—In the customary manner (E. S. R., 59, p. 738) brief reports are given on the progress of various investigations.

At Lafayette apple trees under clean culture showed more vigorous tree growth than those grown with cover crops of alfalfa and grass, even when the latter treatments were supplemented with annual applications of nitrogen. In peach pruning studies at Vincennes a rather heavy thinning accompanied by a comparatively light cutting back gave the best results. In years when there is only a limited number of live fruit buds light pruning is advised with heavier pruning in years af abundant buds. In apple storage studies shredded oiled paper again aided materially in controlling scald. Tests with ethylene gas showed no significant effect in the control of storage scald of Grimes apples, and no effect on the ripening of Grimes or Jonathan after removal from ice storage.

Spring applications of sulfate of ammonia reduced the yield of strawberries and caused the berries to be soft and more susceptible to decay. The use of a 2–12–6 fertilizer as a top-dressing in the spring increased yields in two of three plats, but it is concluded that fertilizer applications are of little or no benefit on soils well supplied with manure and organic matter.

Studies with tomatoes showed that the outer and inner walls of the fruits contain a larger percentage of dry matter and a greater percentage of insoluble solids and have a sweeter taste than do other parts. Evidence was obtained that plant symptoms of malnutrition and microchemical tests may be used to diagnose the fertilizer needs of the tomato. Plants stunted because of low phosphorus supply responded to superphosphate applied as late as August 3. The percentage of dry matter and of sugar in tomatoes produced on potash-starved plants was significantly low as compared with fruits grown on well fertilized plants. Work in the production and improvement of tomato seed was continued. A wilt-resistant Baltimore type tomato suitable for Indiana was developed.

The treatment of arsenic-sprayed apples with hydrochloric acid failed to remove sufficient of the arsenic to meet the Government requirements. No significant effect of hydrochloric acid on keeping quality was noted.

Studies of the seasonal changes in the composition of Stayman Winesap apple trees showed that the amount of free reducing sugars and sucroses varies widely in all parts of the tops and roots of the trees at different seasons of the year, while phlorhizin content shows very little change. Studies with tomatoes, cabbage, corn, and other plants grown in sand or transferred to sand cultures with certain nutrients supplied showed manganese to play an important rôle in carbohydrate synthesis and metabolism. A correlation was observed between the sugar content of corn plants and the amount of potash supplied. An increase of as high as 1,000 per cent was found in the sucrose content of plants on soils fertilized with 126 lbs. of potash, as compared with 36 lbs. per acre.

At the Moses Fell Annex Farm, Rochester, Greensboro, Gold Drop, and Crosby peaches were found relatively hardy in the bud. Supplying the cover crop in the peach orchard with 250 lbs. per acre of mixed fertilizer greatly stimulated the rye growth as compared with superphosphate alone. Grimes and Jonathan apples were held successfully for from one to three months, and late varieties such as Winesap, Rome, York Imperial, and Ben Davis were held in good condition until spring in cool storage chambers.

[Horticultural investigations at the Iowa Station] (*Iowa Sta. Rpt. 1928, pp. 32, 35, 36, 37, 38, 44, 45*).—The usual annual report (E. S. R., 59, p. 38).

Determinations of sugars, dextrin, starch, pentose, fat, nitrogen, and ash made on a series of corn kernels from crosses between Evergreen Sweet and Illinois High Fat (white dent) showed the different forms of carbohydrates to have a constant interrelationship. The controlling genetic force was surprisingly stable and was not disrupted even by varietal crossing. Sweet corn types having as high as or even higher sugar content than the sweet parent were discovered in the progeny. Nitrogen showed but small differences in the parental and hybrid generations. Pentoses, while closely associated with other carbohydrates, were found somewhat independent of their distribution and heredity.

Further studies with the milkweed indicated that the quantity and quality of rubber obtainable was low. The seed fibers were straighter and more brittle than those of cotton but were more buoyant and less affected by moisture. The stem furnished a good source of fiber. Cultural requirements of the milkweed are considered.

Station seedling fruits continued to receive favorable attention from commercial interests. The Patten pear is reported hardy as far north as the north shore of Lake Superior. The Patten plum, a large-fruited American type, is deemed promising, and the Beierschmitt pear, a variety originated at Fairbank, is described as of better quality and greater hardiness than the Bartlett which it resembles. This variety is quite resistant to blight.

At Charles City light terminal pruning combined with the use of nitrate of soda gave the most desirable type of orchard growth, although it did not promote large increases in production. An application of from 3 to 5 lbs. of nitrate of soda applied about 3 weeks before blooming was found most effective for promoting tree growth and fruitfulness. It was noted that practically the entire growth of the fruit spur was made prior to blossom drop.

French crab stock was found susceptible to winterkilling, whereas certain native seedlings came through the same exposures uninjured. Various native stocks showed desirable free rooting tendencies. A Brier Sweet × Mercer crab seedling was found to yield a fine grade of progeny from open-pollinated

. Storage studies with apples indicated that temperatures of from 31 to ?. are too low for certain varieties and may cause the development of a tion termed "soggy breakdown." Grimes and Wealthy were particularly ptible to this type of injury.

ossing experiments with varieties of squash (*Cucurbita maxima*) and eties of pumpkin (*C. moschata* and *C. pepo*) showed that true pumpkins true squashes rarely if ever cross in nature, and if they do the progeny is le.

pple breeding investigations were continued and consisted primarily in a etic analysis of 273 Jonathan seedlings produced from crosses with 11 dif- nt pollen parents. A wide range of variation was observed in the tree and it characters of the seedlings. The breeding characteristics of Jonathan discussed in detail. Salome as a pollen parent produced the largest per- tage of seedlings yielding good to very good fruits. When both parents re red the percentage of red seedlings was increased. In respect to the nsmission of vigor, Antonovka, Anisim, Patten No. 1000, Northwestern eening, Delicious, and Pewaukee were favorable parents, and Salome, Black mette, Jonathan, Black Oxford, and Hubbardston deficient parents. Pear eeding consisted in crossing the best seedlings with high quality standard rieties.

The home vegetable garden, E. S. HABER (*Iowa Sta. Circ. 115 (1929), pp. }, figs. 6*).—General information is presented on the planning, planting, and re of the vegetable garden, including such details as fertilizers, hotbeds, arieties, plant production, culture, storage, etc.

***The translocation of potassium in tomato plants and its relation to their* arbohydrate and nitrogen distribution**, G. JANSSEN and R. P. BARTHOLOMEW *Jour. Agr. Research [U. S.], 38 (1929), No. 8, pp. 447–465, pls. 3*).—Studies at he Arkansas Experiment Station upon the nutrition of tomato plants grown in sand cultures and supplied with nutrients differing in potash content indicated the importance of an adequate supply of potassium as well as of other nutrients. There appeared to be an optimum potassium concentration which was conducive to the normal assimilation of carbohydrates, but this exact ratio was not determined. The data on potassium intake indicated that a large quantity of potassium is absorbed in the early stages of growth and potassium is evidently transferred readily to and from the different parts of the plant. In potassium-starved plants potassium was apparently transferred to and localized in the meristematic tissue, evidently being essential in cell division. In potassium-starved plants the lack of potassium was progressively less from the old to the new leaves.

Nitrogen, both water soluble and total, was more plentiful in low than in high potassium plants, suggesting an inverse relationship between these two nutrients. The percentage of dry matter was high in all parts of the low potassium plants. Abundant potassium in the nutrient solution evidently tended toward a succulent type of growth. Low potassium plants were characterized in the early stages by a very dark green foliage and in the blooming stage by a ruffling of the leaves.

Containers used in shipping fruits and vegetables, H. A. SPILMAN and R. W. DAVIS (*U. S. Dept. Agr., Farmers' Bul. 1579 (1929), pp. II+36, figs. 50*).—The principal types of containers used in handling and marketing various important commodities are described, and, for the most part, illustrated. Great variability is evident, but it is emphasized that many such differences will always exist because of the wide differences in the nature of the commodities and because of localization in supplies of materials for making containers.

That there is considerable room for improvement, both in uniformity and type, is admitted.

Fruit regions and varieties of eastern New York, H. B. TUKEY (*New York State Sta. Bul. 563 (1929), pp. 82, fig. 1*).—Dividing eastern New York into three general promological regions as follows: (1) Champlain Valley, (2) Hudson Valley, and (3) Long Island or coastal region, the author discusses the general soil and climatic situations in each of these areas and describes in brief, nontechnical words the principal varieties of apples, crab apples, pears, quinces, cherries, peaches, plums, grapes, bush fruits, and strawberries grown in the respective regions.

FORESTRY

[Forestry investigations at the California Station] (*California Sta. Rpt. 1928, pp. 77–80*).—Completion (E. S. R., 59, p. 745) of the study of the effect of high temperature on coniferous seedlings is recorded. No striking differences were noted between varieties in the temperature at which death of the protoplasm occurred, 130° F. being approximately the extreme limit of endurance. Appreciable differences were noted, however, in the extent to which tissues of the several species remained cooler than their environment. Plants with large stems remained cooler than did those with small stems. Injury occurred most commonly at the ground level. Seedlings with tall cotyledons were partly protected from injury by their own shade, while seedlings with small stems were literally girdled. In large-stemmed species, such as redwood, the destruction of tissue was often localized, particularly on the side of intensive insolation. Very young stems collapsed quickly under intensive exposure. Seedlings whose cortex had hardened were less subject to injury.

Logging studies in the Sierra pine region showed (1) that slopes up to about 45 per cent when to the advantage of the load decreased the time cost per trip, (2) on medium slopes the time cost of loads of 2,000 bd. ft. was practically the same as that for 1,000 bd. ft., and (3) organization factors affected the time cost more than did factors involving the mechanics of the tractor. Very small logs were found more expensive to handle in certain operations.

The seeds of certain shrubs that quickly invaded burned chaparral areas were found comparatively tolerant to high temperatures. Burning generally decreased the fertility of the soil and was followed by erosion which frequently removed much of the better soil. Studies showed that the removal of the forest duff greatly increased run-off and sedimentation.

Forest plantations [at the Iowa Station] (*Iowa Sta. Rpt. 1928, p. 34*).—A forest plantation established on the Tama Indian Reservation proved highly effective in reducing soil erosion.

The farm timberlot, F. G. WILSON (*Wisconsin Sta. Bul. 407 (1929), pp. 31, figs. 11*).—General information is presented on the farm timber situation in Wisconsin with a view to acquainting the owner with the fundamental principles of land classification, methods of management, and utilization and marketing of lumber products. The fact is emphasized that nearly one-half of the remaining merchantable timber of Wisconsin is in farm holdings. The estimated value of the forest products cut on Wisconsin farms in 1927 approximated $14,000,000; yet it is conceded that farm timberlands are producing only a part of their potential returns. Occupying one-fourth of the farm area, they produce only 3 per cent of the gross income. Overgrazing and the lack of improvement cuttings have reduced possible returns. It is pointed out that timber growing should be made an increasingly important feature in the farm program.

oducing pine nursery stock in the South, P. C. WAKELEY (*U. S. Dept. Leaflet 35 (1929), pp. 8, figs. 4*).—Pointing out the fact that southern pines usually large enough at one year for field setting, the author outlines the lamentals of raising pine seedlings with a view to aiding the landowner, ıer, or school rather than the large commercial enterprise.

'oods burning in the South (*U. S. Dept. Agr. Leaflet 40 (1929), pp. 4*).—A . is presented for the cessation of the practice of spring and fall burning of ·st lands in the South, citing the immense economic loss resulting from burn- and outlining various means, both educational and regulatory, for curbing ; unfortunate practice.

DISEASES OF PLANTS

Plant pathology (*California Sta. Rpt. 1928, pp. 40–44, 89–93, 96, 97*).—vestigations of crown rot of walnut trees have shown that in severe cases the sease spreads from the black walnut stock to the English walnut scion. A ıngus, probably *phytophthora cactorum*, was isolated from diseased tissues, ıd when inoculated into the English walnut bark characteristic lesions were roduced. The eastern and northern California black walnut seemed less sus- ɜptible to the fungus than the southern California species, although a rather ɜvere case of crown rot on the northern black walnut was reported.

Watermelons, squashes, and pumpkins were found to be attacked by *P. citrophthora* following late fall rains.

In studies of the mildew of cantaloupes, shading the plants seemed to favor he development of the disease. Adding potassium permanganate to sulfur used s a dust increased the injury to the foliage. Spraying, dusting, and fertilizer pplications were tested in the Imperial Valley for the control of the mildew, ut only the plats treated with Bordeaux mixture showed any benefit from the pplications.

Investigations on a number of citrus diseases are briefly summarized. A pecies of Torula was found in connection with a gummosis of grapefruit. 'urther studies on the cause of dropping and rotting of navel oranges are said o have shown that *Alternaria citri* is not an important factor in causing June rop. A study of mixed cultures of fruit rotting fungi showed that a mixture f *Penicillium italicum* and *P. digitatum* decreased the rate of decay at most ɜmperatures, but if *Oospora citri aurantii* was added to *P. italicum* the rate ras greatly accelerated. Temperature was found to be important in determin- ıg which fungus of a mixture might be dominant. A brown spotting of Va- ɜncia oranges was found to be caused by *Colletotrichum gloeosporioides* or *A. itri*, or by a combination of the two species following slight injuries.

In addition to the sour orange, the Sampson tangelo, some citranges, Trimble ıngerine, and Lester mandarin were found to be remarkably resistant to Phy- ıiacystis. As a result of cultures and inoculations the identity has been estab- shed of *Bacterium citriputeale* from citrus, with strains of bacteria from lilac, vocado, and apricot.

Prunus mume tested as rootstock was found adapted to commercial apricots, ut not to other stone fruits.

A species of Diplodia which was isolated from date palm was found to be ıpable of destroying normal leafstalk tissues.

Cooperative experiments on the control of endosepsis of figs have shown that r providing clean caprifigs a sound crop of edible figs could be produced.

Investigations on the life history and control of peach rot, *Tranzschelia unctata*, have shown that only the uredinial stage occurs on peach in Cali- rnia. The fungus overwinters on twigs of the current season's growth, infec-

tion taking place in the fall of the year. Spraying with lime-sulfur solution, by preventing twig infection, was found to reduce the attack of the rust in the spring. If spraying is found necessary during the growing season the use of a 1 per cent solution of lime sulfur is recommended, the applications to be made immediately after every rain in May and June.

Spraying experiments for the control of walnut blight are said to indicate that the use of Bordeaux mixture or other copper sprays, applied after the starting of growth in the spring, was beneficial.

Additional evidence was secured to show that sour sap and gummosis of stone fruit trees are of a bacteriological nature and not physiological.

Further studies of the oak fungus root rot, *Armillaria mellea*, which attacks various orchard and ornamental plantings, seemed to indicate that prolonging the life of the tree by surgical methods and the use of resistant roots are the only means of control. Chemical treatments have been unsuccessful.

Exanthema or die-back of prunes and other fruit trees was controlled by applications of copper sulfate to the soil.

A serious disease of apricots, locally known as black heart, was found to be caused by the same species of Verticillium that attacks the tomato.

The successful treatment of chlorosis in pear trees by the introduction of iron citrate into the trunks of the trees was shown in experiments conducted by J. P. Bennett. It is believed that the high lime content of the soil did not prevent the trees from taking up iron, but the absorbed iron was found to be ineffective in the chlorophyll functioning of the leaves.

Applications of from 20 to 70 lbs. of iron sulfate per tree are said to have improved the little leaf condition of peaches, plums, and apricots.

Department of botany (*Indiana Sta. Rpt. 1928, pp. 37–40, figs. 3*).—In addition to testing varieties of wheat and barley for resistance to leaf rusts as a basis for further breeding work, studies were made of the rusts of other economic plants. The rusts of hollyhock and snapdragon were successfully controlled by dusting the plants with sulfur.

The results of cooperative experiments with hybrid recombinations of corn are said to have shown considerable variability in the hybrids as to their adaptability to soil conditions. With the information gained from the experiments outlined, other recombinations were made for further testing.

Tests of soils by the Neubauer method are said to have shown close correlation between the results obtained by this method and by the cornstalk test method.

Tomato dusting experiments showed that copper-lime dust was very effective against the Septoria leaf spot, the dusted plants yielding from 36 to 63 per cent more fruit and of a better quality than the unsprayed plants.

The jimson weed was found to be a carrier of the potato virus which, when combined with the virus of tomato mosaic, caused a severe attack of streak on tomatoes.

Investigations of apple blotch are said to indicate that most of the infection occurred from cankers that originated 2 years previously, indicating a cycle of infection of at least 2 years' duration. By exposing healthy potted apple trees under badly blotched ones it was found that the period of infection varied from 5 days to 6 weeks after petal fall in one locality and between 3 days and 7 weeks in another.

A purple stain of soybeans was found to be due to a fungus. Red clover mildew was controlled by dusting with sulfur.

Botany and plant pathology (*Iowa Sta. Rpt. 1928, pp. 27, 28, 29*).—An intensive study of watermelon wilt is said to have shown that the most logical control lies in the development of wilt resistant strains. Preliminary trials indi-

, that resistant individuals may be selected in the seedling stage by sub- ng seedlings to optimum environmental conditions for the growth of the producing organism. Under such conditions 95 per cent or more of the lings succumbed to the wilt. It remains to be determined whether or not remaining 5 per cent or less were actually wilt resistant.

forts to improve the Conqueror strain resulted in the isolation of several ins which appeared more resistant than the original.

ust disinfection of watermelon seeds was found to be superior to the stand- corrosive sublimate method of seed disinfection. Attempts to retard the earance of wilt in the field by the use of fertilizers and chemicals gave ative results.

elf-pollination of selected strains of the yellows resistant cabbage Iacope ulted in the isolation of a strain which is practically immune from yellows.

For the control of sweetpotato diseases, the results obtained indicate that reral organic mercury dusts appeared to be superior to the corrosive sublimate thod of treatment.

Barley stripe is said to have been very prevalent in 1928, and seed treatment ith a dust composed of corrosive sublimate, sodium bisulfite, and talc increased e yields from 8 to 15 bu. per acre.

Plant protection, E. Riehm and M. Schwartz (*Pflanzenschutz. Berlin: eut. Landw. Gesell., 1927, 8. ed., pp. [5] + 316, pls. 10, figs. 87*).—The four main ections of this condensed introductory account deal, respectively, with plant rotection in general and the public plant protection service, the more impor- ant protective media, general incidence of diseases and injuries of plants, and liseases and injuries of particular cultivated plants.

Action of spray fluids on metals or alloys in apparatus [trans. title], P. Fonduz (*Ann. Agr. Suisse, 28 (1927), No. 1, pp. 28–41*).—The effects of spray fluids on containers, etc., as determined by systematic tests, are tabulated, with discussion in regard to copper, tinned copper, lead, iron, zinc, aluminum, brass, and a special alloy having copper as a base and designated as Bico.

Recent studies on the life conditions of wood-destroying fungi: Immunity [trans. title], W. Bavendamm (*Ber. Deut. Bot. Gesell., 45 (1927), No. 6, pp. 357–367*).—A review of the literature and an account of the author's own work result in a division of wood-destroying fungi into the two general groups. One of these characteristically destroys cellulose, the other lignin, and the two differ characteristically in their relation to oxygen.

Physiologic specialization in Puccinia coronata avenae, H. E. Parson (*Phytopathology, 17 (1927), No. 11, pp. 783–790*).—To confirm or even amplify the findings of Hoerner (E. S. R., 43, p. 653) regarding the existence of physiologic strains of *P. coronata avenae*, the author obtained collections of *P. coronata avenae* from 15 places in the United States and Canada and with these inoculated 27 species, varieties, and selections of cultivated and wild oats.

Of the oat varieties, 4 proved to be differential hosts, and on these 4, or possibly 5, physiologic rust forms have already been distinguished. These differ in their relations to the host plants so distinctly that in some cases the effect on a single host determines the identity of the form. Apparently, the physiologic forms differs also in the readiness with which they produce telia. Such production appears to be independent of the susceptibility or resistance of the variety, and probably inherent. It is thought that in developing oat varieties resistant to crown rust it will be necessary to take into consideration the physiologic specialization of the pathogene.

Action of temperature and soil on the development of Tilletia tritici [trans. title], J. Rapin (*Ann. Agr. Suisse, 28 (1927), No. 1, pp. 79–84*).—A study attempting to compare fungicidal values tabulates tests regarding germination

of *T. tritici* in relation to temperature and studies of soil infection with the spores. Fungicidal wheat seed treatments are also briefly dealt with, including solutions of copper sulfate, mercuric chloride, and formalin. Copper carbonate, which is easy to procure in dust form, gave good results in 1925 and 1926.

[**Cereal disease investigations**] (*California Sta. Rpt. 1928, pp. 56, 57, 58, 59*).—*Oat blast, a nonparasitic disease*, was found by W. W. Mackie to attack all but a few of the cultivated varieties of oats, as well as several wild species of Avena. Kanota and Fulghum oats were practically immune. Crosses between Kanota and Richland, a susceptible variety, segregated in the F_2 generation into 3 susceptible to 1 immune, which indicates that resistance to blast is inherited in a single recessive factor.

Fusarium ear rot is said to be common and destructive to corn in California, but Mackie found that when the seed was treated with organic mercury dusts at the rate of 3 oz. per bushel there was almost a perfect stand in most cases, whereas the average stand from the same lot of seed untreated was about 75 per cent.

Investigations by F. N. Briggs of the inheritance of resistance to bunt of wheat were continued. On the basis of the F_3 generation in a cross between White Odessa and White Federation, resistance to bunt in White Odessa appeared to be due to a single dominant factor.

Attention was also given to a study of modifying factors in connection with resistance to bunt, and from a cross of Hussar, a resistant wheat, with Hard Federation, which shows considerable susceptibility, strains were isolated that bred true for a small percentage of bunt infection. Back crosses were used in breeding commercial varieties of wheat resistant to bunt, and in the experiments reported there was practically no evidence of segregation, all the plants being markedly like the commercial parent.

In experiments on the infection of barley with covered smut, *Ustilago hordei*, it was found that dehulling the seeds with sulfuric acid gave as satisfactory infection as could be induced in seeds dehulled by hand. Collections of covered smuts of barley made from different parts of the State were tested in 7 varieties, and the results indicate that at least 3 strains of covered smut are represented in the collections thus far tested.

Corn disease studies (*Iowa Sta. Rpt. 1928, pp. 54, 57–59*).—Studies were reported on the resistance of pure lines of corn to smut, Diplodia, and Fusarium infections, and marked differences in resistance of different pure lines, as well as in their F_1 combinations, were noted between very closely related strains. It is believed that strains of corn can be produced for general planting that are relatively free from smut.

Downy mildew of corn, which is due to *Sclerospora graminicola*, was observed in Iowa. The fungus is said to be found commonly on green foxtail in cornfields. The mildew was found capable of attacking corn under greenhouse and field conditions, and pop corn proved more susceptible than sweet corn, while field corn was less susceptible than either pop or sweet corn. This fungus is said to have been found occurring naturally on corn only twice, in one case on dent corn seedlings, and on sweet corn in the ear stage of its development.

Investigations on the relation of the morphology of the corn plant to infection by smut were carried on in the greenhouse and field. Plants having open terminal leaf spirals were found to show 74 per cent infection, while those with closed terminal leaf spirals showed only 27.3 per cent infection. No correlation was found between the percentage of infection in the greenhouse and natural field infection.

Studies of the dry-rot diseases of corn are said to have shown that the Diplodia dry-rot organism progresses in stored infected ears until the ears become rela-

ely dry. The most important aspect of Diplodia seedling blight is the rotting the susceptible mesocotyl. Chemical dust seed treatments were found to tard or prevent the rotting of the mesocotyl, and this effect was reflected in tter field stands.

"Take-all" in wheat, S. FISH (*Jour. Dept. Agr. Victoria, 25 (1927), No. 7,*). *423–425*).—It is estimated that wheat crops in the Murrayville (Victoria) istrict suffered reductions of from 5 to 60 per cent as a result of the incience of take-all (*Ophiobolus graminis*). *Wojnowicia graminis* was often presnt, sometimes in connection with the true take-all fungus. The facts developed uring an inspection tour are briefly outlined. The investigation indicated hat the liability of a recurrence of take-all could be minimized by burning the tubble, early fallowing, and keeping the ground clean, especially of barley rass and silver grass.

The Fusarium disease (wilt) of cotton and its control, T. FAHMY (*Phytopathology, 17 (1927), No. 11, pp. 749–767, figs. 8*).—This account represents, in condensed form, the detailed bulletin which is noted below.

The Fusarium disease of cotton (wilt) and its control, T. FAHMY (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 74 (1928), pp. VII+106, [pls. 48]*).—An account is detailed of the Fusarium disease of cotton, which has been shown to cause much loss to cotton interests, particularly in the Nile Delta where Sakel is the prevailing variety. The external and internal symptoms are given. The fungus, which persists in the soil and which may infect cotton more or less severely as influenced by various factors, produces under artificial conditions a toxin causing cotton seedling wilt. The relations between host and parasite are outlined, with an account of the isolation, morphology, and cultural characters of the causal fungus (*F. vasinfectum*). For this, in its local form, the author suggests the varietal designation *F. vasinfectum egyptiacum*, as it disagrees in certain characters with the form causing the wilt disease in India and America.

Methods of control are discussed. Bare fallow is useless. Soil disinfection with carbon disulfide proves expensive and impracticable. Different cotton varieties were tested as to susceptibility. From the susceptibe Domains Sakel four resistant strains have been separated. These have been grown in heavily infected soil during two consecutive years and have yielded a product graded as Sakel of good quality. The method for future propagation is given.

Onion diseases (*Iowa Sta. Rpt. 1928, p. 59*).—The sudden development of an unknown virus disease in epidemic form on onions is reported. It was first observed in 1927 and occurred again in 1928. The disease is said to be present in the bulbs but not in the seed, and experiments showed that the virus was transmissible to healthy plants.

Purple blotch of onion (Macrosporium porri Ell.), H. R. ANGELL (*Jour. Agr. Research [U. S.], 38 (1929), No. 9, pp. 467–487, pls. 3, figs. 8*).—The results are given of morphological, physiological, and pathogenicity studies of *M. porri*, the cause of purple blotch of onion. The leaves, stems, and bulbs of the onion were found to be subject to attack, but the disease is considered to be of minor importance in the rotting of sets and market onions.

According to the author, *M. porri* is almost always found associated with *M. parasiticum* or *Thyrospora parasitica*, as it should be called. The latter species is considered to be a saprophyte. The fungus was compared with *M. solani*, and the only differences noted were in their pathogenicity. Cross-inoculation experiments always gave negative results.

For the control of purple blotch the author suggests the thorough curing and drying of the onions after harvest, and storage in a well-ventilated store

house kept at temperatures between 33 and 36° F. No experiments for the control of the disease on the leaves and seed stalks were undertaken.

A potato virus on peppers, F. M. Blodgett (*Phytopathology, 17 (1927), No. 11, pp. 775–782, figs. 3*).—A disease of peppers that is said to be serious, though at present uncertain as to the exent of its occurrence in commercial fields, and producible by inoculation with virus from apparently healthy commercial potato varieties, is thought to be due to that virus B from potatoes which Fernow (E. S. R., 54, p. 842) is said to have used to inoculate *Nicandra physalodes*, *Nicotiana glutinosa*, and 6 other hosts, and which Johnson (E. S. R., 54, p. 249; 57, p. 252) is said to have claimed as the cause of mottle on tobacco and as transmissible to some 30 plant species. The symptoms on pepper are described. The virus is readily inoculable from one pepper to another, but it is not transmitted through pepper seed or potato seed, although it is transmitted through potato tubers.

The diseases of sugar beet, O. Appel (*London: Ernest Benn, 1927, pp. [49], pls. 22*).—To the corresponding German edition (E. S. R., 57, p. 646) the present English translation by C. L. Wood, edited by R. N. Dowling, adds two plates, with corresponding descriptive pages, on wireworms and mosaic disease, respectively.

[Breeding sugar beets for resistance to curly top] (*California Sta. Rpt. 1928, p. 68*).—It is reported that a strain of sugar beets grown at the Davis Substation showed marked resistance to curly top disease, but the sugar percentage in the beets was quite low. The resistant strain was crossed with high sugar strains, and the performance of the progeny is under investigation.

Sugar beet mosaic [trans. title], E. W. Schmidt (*Ber. Deut. Bot. Gesell., 45 (1927), No. 9, pp. 598–601, figs. 2*).—Chiefly, this short article deals with the presence and relative abundance of calcium oxalate in normal, etiolated, or deep green portions of sugar beet leaves as in relation to the presence and extent of mosaic.

A chemical control for sweet potato wilt or stem rot, R. F. Poole and J. W. Woodside (*North Carolina Sta. Tech. Bul. 35 (1929), pp. 18, figs. 5*).—An investigation of the method of attack of the stem rot organism showed that in the majority of cases the fungus gained entrance to the sweetpotato plant through the basal end of the stem. Preliminary experiments showed that a number of fungicides could be applied to the roots and stems without causing injury, and this led the authors to experiments on the control of wilt or stem rot by treating the plants before they were set in the field. The stems of all plants were cut just above the ends, and the roots and stems were dipped into a heavy spore suspension, then into liquid treatments and transplanted immediately. Where dusts were used the roots and stems were placed in a paper bag and uniformly covered with dust by revolving or shaking.

The results of the field trials were so successful that the authors recommend dipping the plants, just before transplanting in the field, in Bordeaux mixture or thoroughly dusting them with a copper sulfur lime dust.

In addition to the treatment suggested, it is considered necessary to maintain a healthy seed stock. Dipping or dusting after the plants had become infected did not prevent disease. The most advantageous time to make the treatment is considered to be just before transplanting, while the roots and stems are turgid. The soil moisture should be sufficiently high at this time to promote the growth of the plants and to prevent chemical injury.

Forced ventilation of tomato plant beds (*Indiana Sta. Rpt. 1928, pp. 52, 53*).—It is stated that in an experimental bed tomato plants inoculated with Cladosporium and Septoria did not develop these diseases when the foliage was

; dry by the circulation of warm air with an electric fan. Dusting the beds ı copper dust at weekly intervals also proved effective as a control measure.

. **garden fungus disease**, C. C. BRITTLEBANK and S. FISH (*Jour. Dept. Agr. toria, 25 (1927), No. 6, pp. 380, 381*).—A wilt of tomatoes, Iceland poppies, (other garden plants in Victoria caused by ***Phytophthora cryptogea*** is said have been first observed in Australia in 1909 on cinerarias grown in a glass- ıse near Melbourne. Since that time it has spread rapidly, until it is not ;y a serious disease of tomato seedlings but also one of the principal fungus ıeases of the flower gardens, attacking primulas, lupines, wallflowers, asters, d antirrhinums. Tomato plants appear to be immune after they grow to be in. high. Iceland poppies, attacked usually when the buds are about 2 in. ›ove the ground, do not usually reach the flowering stage. Cinerarias, lupines, allflowers, asters, and antirrhinums wilt at flowering time. Details of the fe history, cultural features, and inoculation experiments were to be pub- shed later.

The means of carrying over from season to season is not certainly known. 'lants once affected can not be cured but must be burned. Soil sterilization rith steam has, so far as tried, been completely successful. At the Cheshunt Experiment Station, the Cheshunt compound (copper sulfate, 2 parts by weight, ınd ammonium carbonate, 11 parts) checked the disease. Directions are ietailed.

Calcium sulphide for the control of apple and peach diseases, R. H. HURT and F. J. SCHNEIDERHAN (*Virginia Sta. Tech. Bul. 36 (1929), pp. 15, figs. 2*).—The results are given of experiments with calcium sulfide used in orchards for the control of diseases of apples and peaches. The experiments extended over a 2-year period, and they are said to indicate that calcium sulfide is a comparatively noncaustic spray material that can be used throughout the season on varieties subject to spray injury. A high finish on the fruit and a minimum of foliage injury resulted from the use of this new fungicide.

When used throughout the spraying season on apples, calcium sulfide gave better results in scab control than the standard spray recommended based on the use of lime sulfur followed by Bordeaux mixture. In the authors' experiments, calcium sulfide was used throughout the season on such varieties as Winesap and Ben Davis. With varieties of apples which are subject to bitter rot, this material can not replace Bordeaux mixture for the late summer applications.

In comparative tests to determine the caustic reaction to leaves and fruits of both apples and peaches, calcium sulfide was found to be less caustic than any of the fungicides in common use.

Brown rot of apples (*Jour. Dept. Agr. Victoria, 25 (1927), No. 12, pp. 763–765*).—Information on apple brown rot and on measures for its control is credited to H. Wormald, of the Horticultural Research Station, East Malling, Kent, England. It is stated that during recent years the brown rot fruit disease caused by *Sclerotinia fructigena* has been very prevalent, apples and pears showing severe attack and the plum crop considerable loss.

Brown rot of peaches, S. FISH (*Jour. Dept. Agr. Victoria, 25 (1927), No. 7, pp. 409–411, fig. 1*).—Brown rot is the most destructive of all diseases of the peach in Victoria. This disease was first identified in the State by McAlpine in 1902. In 1914, specimens were received from several districts, and an outbreak became widespread in 1918. In epidemics at that time and since growers have lost entire crops. Since 1921 the disease has spread rapidly throughout the Goulburn Valley peach areas. The favoring conditions, attack, and symptoms are described, and control measures are outlined, including removal of

diseased wood and mummies and four sprayings with lime sulfur. The lime-sulfur treatment greatly increases the carrying capacity of the fruit in its relation to marketing.

Two fungi on Sclerotinia apothecia, W. N. Ezekiel (*Phytopathology, 17 (1927), No. 11, pp. 791, 792, fig. 1*).—In experiments previously reported (E. S. R., 56, p. 748) with apothecia of the peach brown-rot fungus, *S. americana* (*S. fructicola*), two other fungi were found growing out of the brown-rot apothecia. The more common and rank form was a Fusarium, the other a Trichoderma (*T. lignorum* or *T. koningi*). It is thought unlikely that even the Fusarium is of practical importance as a natural enemy of the brown-rot Sclerotinia.

"Shot-hole" of apricots (Coryneum beijerinckii, Oud.), S. Fish and A. A. Hammond (*Jour. Dept. Agr. Victoria, 25 (1927), No. 7, pp. 403–408, figs. 6*).—Experiments outlined indicate that for the control of apricot shot-hole the best results are obtained by means of two sprayings with the standard Bordeaux mixture 6–4–40, one applied when the trees are dormant and the second when the buds are showing pink. Results from the use of Burgundy mixture are not so satisfactory. Lime sulfur, as used in the experiments, did not effectively control shot-hole, and where 1–40 lime-sulfur spray of 32° B. was applied in the spring, the leaves and fruit were injured.

Fungus parasites of cherry [trans. title], H. Faes and M. Staehelin (*Ann. Agr. Suisse, 28 (1927), No. 1, pp. 1–13, figs. 5*).—In this portion of a statement, a second part of which deals also with insect pests, an account is given regarding the biology, importance, and control of *Clasterosporium carpophilum*, with briefer accounts regarding *Sclerotinia* (*Monilia*) *cinerea* and *Gnomonia erythrostoma*.

Reversion of black currants.—I, Symptoms and diagnosis of the disease, J. Amos and R. G. Hatton (*Jour. Pomol. and Hort. Sci., 6 (1927), No. 3, pp. 167–183, pls. 7*).—Leaf characters of normal and reverted black currant bushes are discussed in detail as regards varietal differences, leaf position, and leaf types. Leaf veining and serration are the only sure diagnostic characters to be depended upon in roguing. The causes of false reversion are presented, and methods of distinguishing this from true reversion are outlined. Less constant characteristics of reversion, as nettle-headedness, flower character, and noncropping, are described as additional aids to diagnosis. Series of experiments on various aspects of this work are detailed, with figures and measurements.

A Gloeosporium blight of raspberry, B. O. Dodge (*Phytopathology, 17 (1927), No. 11, pp. 769–774, pls. 2*).—For Gloeosporium blight, reported on red raspberry hybrids in Maryland and Virginia and on commercial varieties of black raspberries in Kentucky, Michigan, Ohio, and other States, the symptoms are described and differentiated from those of spur blight and bluestem or wilt.

A chromogenic Gloeosporium has been isolated from blighted red raspberry canes at Glenn Dale, Md., each spring since 1922. Pure cultures of a nonchromogenic strain of this fungus were obtained by plating from a chromogenic culture which was contaminated with bacteria. The claim is put forth that the strains of Gloeosporium from raspberries can not be distinguished morphologically from those commonly found on apples and referred to as *Glomerella cingulata* or *Gloeosporium cingulatum*. Cross inoculations with the chromogenic strain from raspberry and with a chromogenic and a nonchromogenic strain from apple proved the pathogenicity of each of the three strains on both hosts. Tests with spore suspensions show that ordinarily the fungus does not penetrate readily the unbroken epidermis, and preliminary tests suggest that anthracnose lesions may enable invasion by *G. cingulatum*.

Sulphuring and spraying vines, F. DE CASTELLA (*Jour. Dept. Agr. Victoria, 25 (1927), No. 12, pp. 732–735*).—Attention is drawn particularly to the desirability of sulfuring vines, both for the control of Oidium and for the tonic effect on the grapevines, also to the advisability of a Bordeaux spray in January to prevent downy mildew and premature defoliation.

The biology of Uredineae in Liliaceae [trans. title], W. SCHNEIDER (*Centbl. Bakt.* [*etc.*], *2. Abt., 72 (1927), No. 8–14, pp. 246–265, figs. 2*).—The data detailed are for *Uromyces scillarum*, *U. lilii*, and *Puccinia schroeteri*.

Studies on fruit cast of some conifers [trans. title], D. FEHÉR (*Ber. Deut. Bot. Gesell., 45 (1927), No. 5, pp. 255–261, pl. 1, fig. 1*).—The work previously noted (E. S. R., 57, p. 321) has been followed up by studies on conifers, including *Pinus strobus*, *P. strobus excelsa*, *P. sylvestris*, *P. nigra*, *P. ponderosa*, *Picea excelsa*, *P. nigra*, *P. alba*, *Larix europaea*, *Tsuga canadensis*, *T. mertensiana*, *Abies veitchii*, *A. alba*, and *Biota orientalis*. The results confirm those previously announced in that the separation is due to the formation of a separation layer which results from the splitting of living cells. Particulars showing variations are indicated.

Elm disease [trans. title], A. BRUSSOFF (*Centbl. Bakt.* [*etc.*], *2. Abt., 71 (1927), No. 8–14, pp. 298–300*).—A critical note, referring to the article by Von Linden and Zenneck (E. S. R., 58, p. 853) and to a previous article by the present author (E. S. R., 55, p. 656).

The willow scab fungus, Fusicladium saliciperdum, C. P. CLINTON and F. A. MCCORMICK (*Connecticut State Sta. Bul. 302 (1929), pp. 441–469, pls. 8*).—The occurrence of willow scab in Connecticut was reported by the senior author in 1927. Since that time it was ascertained by the authors to be present in a number of localities in Connecticut and in the States of New York, Massachusetts, New Hampshire, and Maine, and in Nova Scotia and New Brunswick, Canada. It was also reported to occur in Vermont, but this was not confirmed.

The disease appears to be most severe on large trees, and *Salix alba vitellina*, a common shade tree, is especially subject to attack, the trees often being defoliated. When trees are severely attacked several years in succession, they are often killed. Nine species of willows were found to be attacked by the fungus in Connecticut, and seven more are reported subject to infection in eastern North America.

Spraying experiments were undertaken for the control of the disease, the trees being sprayed while dormant with Bordeaux mixture; followed by applications of Bordeaux mixture or lime-sulfur solution, five applications of the fungicides being made. In September the sprayed trees had retained most of their foliage, whereas the unsprayed ones were practically defoliated. Little difference was shown between the trees which were sprayed with Bordeaux mixture and those which received lime sulfur. No leaf injury was noted from either fungicide.

The fungus is said to have been known in Europe for many years, and its history in that country is briefly reviewed.

A bibliography of 78 titles, with notes on the fungus, is given.

[Nematode studies] (*California Sta. Rpt. 1928, pp. 71, 72*).—Investigations by J. Tyler in culturing the root knot nematode, *Caconema radicicola*, have resulted in the development of a method for obtaining and keeping the larvae in an uncontaminated culture, and a method has also been worked out for observing the development of the eggs. The rate of development is said to increase with rising temperature. At 27° C. (80.6° F.) the development from larval stage to egg laying was accomplished in 17 days, while at 15.5°, 63 days

were required for the same life history. Above 31° development was negligible. As a result of over 1,000 experiments it was found that development to egg laying requires 6,000 hour-centigrade degree units above an arbitrary developmental zero at 12°.

ECONOMIC ZOOLOGY—ENTOMOLOGY

The principles of applied zoology, R. A. Wardle (*London, New York, and Toronto: Longmans, Green & Co., 1929, pp. XII+427, pl. 1, figs. 55*).—Part 1 of this work deals with medical and veterinary zoology (pp. 1–144), part 2 with agricultural and horticultural zoology (pp. 145–284), and part 3 with animal industries (pp. 285–380). A bibliography of 27 pages is included.

The mouse infestation of Buena Vista Lake basin, Kern County, California, September, 1926, to February, 1927, S. E. Piper (*Calif. Dept. Agr. Mo. Bul., 17 (1928), No. 10, pp. 538–560, figs. 12*).—This is a detailed account of the outbreak in Kern County, Calif. An account of the outbreak by Hall (E. S. R., 57, p. 159) and a report upon the part that disease played in control by Wayson (E. S. R., 58, p. 172) have been noted.

The names of worms, E. L. Taylor (*Vet. Rec., 9 (1929), No. 8, pp. 148–150*).—The author here presents a list of correct names and the synonyms of nematodes, cestodes, trematodes, and Acanthocephala.

The metabolism of insects, M. H. Sayle (*Quart. Rev. Biol., 3 (1928), No. 4, pp. 542–553, figs. 4*).—This account is presented in connection with a list of 36 references to the literature.

An annotated list of some parasitic insects, F. W. Poos (*Ent. Soc. Wash. Proc., 30 (1928), No. 8, pp. 145–150*).—An annotated list is given of the parasites reared in eastern Virginia during the seasons of 1926 and 1927 from 19 distinct hosts.

[Report of work in entomology and parasitology at the California Station] (*California Sta. Rpt. 1928, pp. 32–35, 70, 71, 72–77, 117*).—Tests of some eight other materials have shown that for citrus fumigation none approaches cyanide for availability. Chloropicrin was the most toxic with a ratio of 1:3 as compared with liquid hydrocyanic acid on the red scale, but the plant tolerance was much less, and a tear gas is objectionable when used out of doors on a large scale.

In control work with the citrophilus mealybug (*Pseudococcus gahani*), in which the trees were washed with water applied from the irrigation system under a pressure of about 75 lbs., by means of a centrifugal pump mounted on an automobile chassis, the application of 700 or 800 gal. was found necessary on fairly large trees. Specially treated β-naphthol bands were found to prevent reinfestation by washed-off mealybugs that attempt to ascend the trees.

Two new pests of the walnut, *Rhagoletis juglandis* and *Euxesta notata*, occur together and are becoming important near Chino and Pomona. This is said to be the first record of the appearance of *R. junglandis* in California and the first record of Euxesta attacking walnuts.

Investigational work is being conducted with the citricola scale *Coccus pseudomagnoliarum*, which is becoming resistant in certain areas to treatment with hydrocyanic acid gas. A satisfactory kill was obtained in one grove from a fumigation applied in March.

In work with *Glyptocelis squamulata*, a new bud pest of the vine in the Coachella Valley, white-washing the canes gave promise of satisfactory control.

It was found that a relatively large percentage of walnut codling moth worms are killed by lead arsenate applied a week or two after they hatch out.

Reporting upon beneficial insect investigations, it is stated that colonies of two ladybird beetles, *Chilocorus bipustulatus* and *Exochomus quadripustulatus*, were secured by E. W. Rust from South Africa. The first-mentioned ladybird beetle has persisted in lemon groves over winter, but the latter has not been recovered. Six different enemies of the citrophilus mealybug (*P. gahani*) were successfully introduced into California from Australia by H. Compere, namely, two internal hymenopterous parasites, *Tetracnemus* sp. and *Coccophagus gurneyi* Compere, two coccinellids (*Pullus* sp. and *Diomus* sp.), *Chrysopa* sp., and a dipterous predator, *Diplosis* sp. Several beneficial insects of minor importance were also introduced into California by Compere, including the ladybird beetles *Orcus australasiae*, *Leis conformis*, and *Coccinella transversalis*. In work conducted at the temporary laboratory established at Fullerton, Orange County, it was found that it may occasionally be necessary to supplement the work of the ladybird beetle *Cryptolaemus montrouzieri* in the control of mealybugs on citrus. Trapping and destroying the ovipositing mealybugs and egg masses in bands or pieces of burlap placed in the trees promises to be a good supplementary practice.

Reference is made to work with the orange worms *Tortrix citrana* and *Holcocera iceryaeella*, no satisfactory control for which has yet been found. An investigation of a heavy infestation of worms doing damage in several grapefruit plantings at Yuma, Ariz., revealed the presence of *Platynota chiquitana*, a species that occurs in California.

In control work by L. M. Smith with the snowy tree cricket, which has caused heavy losses to the raspberry growers in the Santa Clara Valley, the application of sodium fluosilicate dust by 75 per cent of the growers gave a satisfactory control in 1928. The method devised consisted of a single application of a dust composed of 70 per cent of sodium fluosilicate and 30 per cent of diatomaceous earth applied at the rate of 50 lbs. to the acre. This dust applied between the first and second crops, at which time there are few or no berries on the bushes, is said to give perfect control in 15 days. The picking of berries from dusted bushes is forbidden for a period of from 10 days to 2 weeks, during which time those on the bushes at time of dusting ripen and come off, leaving clean berries to come on later.

The strawberry root worm was found by Smith to have rapidly increased its area of infestation on raspberries in the Santa Clara Valley. The adults of this pest, of which there is a single generation a year, are very destructive to the foliage during the late summer, and as the leaves dry up, they attack the canes at the base and feed upon the green bark.

In work conducted by A. C. Davis in cooperation with the U. S. D. A. Bureau of Entomology, damage by the pepper weevil was prevented through the application of calcium arsenate dust at the rate of 6 to 8 lbs. per acre repeated several times, depending upon the infestation. Chili peppers dusted after the pods were about 1 in. in length were washed in a 2 per cent solution of commercial hydrochloric acid before drying to remove the arsenical residue. The arsenical was removed from pimiento peppers in the canning process.

Red spider injury to deciduous fruits, observed by J. F. Lamiman in 1927, was due to *Tetranychus pacificus* McG. rather than *T. telarius* (L). Heretofore, *T. pacificus* had not been reported as injuring prunes and almonds, although its close resemblance to *T. telarius* may account for this.

In work conducted by A. D. Borden, losses from the fruit tree leaf roller were materially reduced in the Watsonville district by the use of dormant oil sprays in winter and with early arsenical sprays in the pink and calyx periods. Bait traps were successfully introduced and employed by Borden as indicators of codling moth activity and as a means of timing sprays.

In work with the mealy plum aphid, E. O. Essig obtained early summer control by the use of 7 lbs. of fish oil or whale oil soap to 200 gal. of water.

In work with the mountain mosquitoes *Aedes communis* and *A. hexodontus*, S. B. Freeborn found oiling operations not only to control the existing larvae but to prevent oviposition in oiled pools. It is pointed out that since these mosquitoes are single brooded, one spraying with 27° oil is sufficient for two years' control. It was found by Freeborn that nicotine sulfate, 40 per cent nicotine, when painted on the roosts will effectively remove all lice from poultry, and the same type of treatment is also effective for the sucking louse of the white rat.

It was found by O. Swezy and H. H. Severin that a Rickettsia-like microorganism is present in infective beet leafhoppers. The work suggests that this organism has a filtrable stage in its life cycle. It was shown by Severin that noninfective beet leafhoppers after feeding on unfiltered root juice extracted from diseased beets, also on juice filtered through fine Berkefeld candles, heated for a period of 10 minutes in water at 70° C., transmitted curly top to healthy beets. Negative results were obtained at 75°. He has also shown that noninfective beet leafhoppers after feeding on root juice expressed from diseased beets, filtered through fine Berkefeld candles and kept in test tubes plugged with equal parts of vaseline and paraffin for a period of 9 weeks, transmitted curly top to beets.

In explorations for parasites of the beet leafhopper in Mexico during the year, by C. F. Henderson, neither the beet leafhopper nor parasites were found on the high central plateau which extends from the southern portion of Durango to Mexico City. On the west coast the range of the leafhopper apparently extends only as far south as Guasave, Sinaloa.

In dusting experiments by F. H. Wymore for the control of *Diabrotica soror* and *D. trivittata* on cucurbits, plats treated with hydrated lime or with gypsum repelled the beetles and produced as large a crop as did plats treated with these materials plus various amounts of arsenical poisons.

Studies on the control of slugs, particularly the gray garden slug (*Agriolimax agrestis*) were continued at Davis. It was found that under garden conditions a spray consisting of potassium alum or ammonia alum, 0.75 to 0.5 lb. per gallon of water, applied at night destroyed most of the individuals actually reached. Two or three subsequent applications at intervals of approximately three weeks will kill newly appearing young slugs or those escaping the first treatment and make the subsequent damage nominal. The use of poisoned bait has proved unsatisfactory for slugs in the presence of young green vegetation, although the bran and calcium arsenate formula continues to prove effective in other localities on the European brown snail (*Helix aspersa*).

[Work in economic entomology at the Indiana Station] (*Indiana Sta. Rpt. 1928, pp. 18–22, 42, 43, 44, 64, 65*).—An account is first given of the progress of work with the European corn borer, which has been found in limited numbers on scattered farms in counties of the northeastern part of the State.

The codling moth is reported upon under the headings of clean-up project, spray substitutes, packing shed sanitation, parasites, and educational work. Attempts to find effective substitutes for arsenate of lead have thus far given negative results. Bait traps have given little promise in Indiana. Banding has been recognized as an effective method of destroying some worms, but is open to the objection that the bands need examining every 10 days to destroy the worms that have accumulated. Studies of the daily emergence of moths from packing sheds have shown conclusively that sheds are an important source of infestation, 5,500 moths having been caught in one window at the

Bedford packing shed. The artificial introduction of *Trichogramma minutum* even late in the season resulted in the parasitization of 75 per cent of the codling moth eggs. Control recommendations have been previously noted (E. S. R., 59, p. 760).

Continued experiments at Vincennes (E. S. R., 59, p. 758) have shown that cat-facing of peaches may be caused by the tarnished plant bug. Tests of *calcium cyanide dust, cresylic acid dust, nicotine dust,* and *nicotine spray* for the control of this pest largely gave negative results.

Further studies of the effect of Bordeaux mixture and copper sulfate solution on the efficiency of oil spray for San Jose scale are said to corroborate former conclusions that Bordeaux mixture reduces the efficiency at concentrations up to 1.5 per cent of the actual oil, but is not detrimental to the higher strengths of oil.

Attempts were made to establish the alfalfa weevil parasite *Anaphes pratensis.*

Losses of from $3,000 to $5,000 a year have been caused by the greenhouse centipede in some commercial vegetable greenhouses. Investigations conducted indicate the possibility of complete control by soil fumigation with carbon disulfide with steam as a carrier. In small tests where steam was not available the injection method also gave satisfactory results.

Effective control of the cottony maple scale and elm scurfy scale was obtained by the use of dormant oil sprays. The use of summer oils and other insecticides to control the oyster shell scale gave satisfactory results. Dry Bordeaux mixture gave the best results of the several insecticides tested against the black flea beetle, a common pest of potato, eggplant, and other garden crops, while sodium fluosilicate was fairly effective.

[Report on entomology at the Iowa Station] (*Iowa Sta. Rpt. 1928, pp. 32, 33, 59, 60, 61*).—Reference is here made to the occurrence of several of the more important insects of the year, including two species of sod webworms, which were abundant in the spring of 1928 and badly injured several fields of corn and together with cutworms entirely destroyed a few fields in the southern part of the State.

No commercial damage was done by the Hessian fly in the State in 1927, and the wheat stem maggot did slight damage throughout the winter wheat growing region of the State. The meadow plant bug was abundant in southeastern Iowa, a 40-acre wheat field near Muscatine having been almost destroyed by it.

It is reported that the imported onion maggot (*Pegomyia ceparum* Meig.) the black onion fly (*Tritoxa flexa* Wied.) greatly increased in numbers in the onion growing districts at Saint Ansgar and Pleasant Valley. Slight infestations were also found at Clear Lake. The barred-winged onion fly (*Chaetopsis aenea* Wied.) and the seed corn maggot (*P. fusciceps* Zett.) were also reared from onions in these localities, and the onion thrips caused considerable damage to onion fields north of Davenport. *P. fusciceps* practically destroyed 8 acres of seedling muskmelons near Fayette in June, having appeared when the plants were about 2 in. high.

Investigations of the native stalk borers were continued during 1927 (E. S. R., 59, p. 55), the stalk borer having been studied in detail and its life history and habits determined. Ten species of parasites, 2 of which were very active in holding the stalk borer in check, were reared, and 5 predatory species were observed attacking it in the field. The caterpillars of 9 other species of the genus Papaipema were studied, the larvae of 3 of which occasionally attack corn. Most of the species of the genus studied, however, appear to prefer certain wild host plants and are not of much economic importance.

The 4-lined corn borer (*Luperina stipata* Morr.) appeared in destructive numbers during the past two seasons, its activities apparently being largely confined to wild grasses, especially slough grass (*Spartina michauxiana*). Four species of parasites and 3 predatory insects were observed attacking the larvae in the field. The spindle worm (*Achatodes zeae* Harr.), a common borer in the stems of elderberry, was found injuring corn along the edge of a field near an old elderberry thicket. Life history studies of the smartweed borer (*Pyrausta ainsliei* Hein.) and the lotus borer (*P. penitalis* Grote) were continued (E. S. R., 59, p. 55), four parasites having been reared from their larvae.

[Economic insects and their control in Kansas] (*Kansas State Hort. Soc. Bien. Rpt., 39 (1926-27), pp. 11-35, 65-71*).—The papers relating to the subject here presented include the following: Results of Government Tests for the Control of the Codling Moth in Kansas, by P. M. Gilmer (pp. 11-15); Comparison of Dust and Liquid Sprays in the Control of Insects and Diseases, by G. W. Kinkead (pp. 15-18); Study on Arsenical Tolerance of Insects, by E. G. Kelly (pp. 18-21); Quarantines and the Work of the Kansas Entomological Commission (pp. 21-25) and The Entomological Commission and Its Protection for the Horticulturist (pp. 25-31), both by H. B. Hungerford; Some Mites Infesting Fruit Trees, by G. A. Dean (pp. 31-35); and Spray Schedules for Kansas, by W. R. Martin, jr. (pp. 65-71).

The insects of Bermuda, L. OGILVIE (*[Hamilton]: Bermuda Dept. Agr., 1928, pp. 52, fig. 1*).—This is an annotated list, systematically arranged, of the insects of Bermuda.

[Economic insects and insecticides in England] (*Jour. Southeast. Agr. Col., Wye, Kent, No. 25 (1928), pp. 59-82, 86-115, figs. 44*).—The papers here presented include the following: Pyrethrum Experiments, by M. Austin and F. V. Theobald (pp. 59-67); The Nut Bud Tortrix (*Epiblema penkleriana* Schiff.) (pp. 68-70), the Rosy Rustic Moth (*Hydroecia micacea* Fab.) as a Hop Pest (pp. 71-74), and The Large Cabbage White Butterfly (*Pontia brassicae*) and a Simple Method of Control (pp. 75-78), all by F. V. Theobald; Notes on a New Mushroom Pest and on the Control of Sciara Larvae, by F. V. Theobald, and a Note on the New Cecid Pest by H. F. Barnes (pp. 79-82); Preliminary Note on the Cherry Fruit Moth (*Argyresthia nitidella* Fabr.), by F. M. Wimshurst (pp. 86-89); and The Biology of Flea-Beetles (Phyllotreta) Attacking Cultivated Cruciferae, by H. C. F. Newton (pp. 90-115).

[Economic insects in Russia] (*[Gosud. Inst. Opytn. Agron., Leningrad], Izv. Otd. Prikl. Ent. (Rpts. Bur. Appl. Ent.), 3 (1928), No. 2, pp. 113-272, 281, pl. 1, figs. 46*).—The translated titles of the studies here reported are as follows: *Locusta migratoria* L. in Central Russia, by S. A. Predtechenskiĭ (Predtetshenskij) (pp. 113-199, Eng. abs. pp. 192-197); On the Biology of the Parasites of *Feltia segetum* Schiff., by N. F. Meĭer (Meyer) (pp. 201-218, Ger. abs. pp. 214-217); On the Biology of *Trichogramma barathrae* n. sp., by G. P. Skripchinskiĭ (Skriptshinskij) (pp. 219-224, Ger. abs. pp. 222, 223); On the Ichneumonid Fauna of the South Ussuri Region, by D. D. Goloviznin (Golovisnin) (pp. 225-228); Contribution on the Biology and Ecology of *Hylemyia brassicae* Bché. and *H. floralis* Fall., by K. I. Vodinskaîa (Vodinskaja) (pp. 229-249, Ger. abs. pp. 247, 248); The Dipterous Larvae Attacking Cultivated Gramineae, by E. A. Kreĭter (Kreuter) (pp. 251-264, Ger. abs. p. 264); The Hibernation of *Anthonomus pomorum* L., by M. T. Aristov (pp. 265-272, Ger. abs. p. 272); and The Synonymy of the Melon Fly *Myiopardalis pardalina* Big. (=*M. caucasica* Zaitz.), by A. A. Shtakel'berg) (Stackelberg) (p. 281).

[**Entomological research work**] (*Philippine Bur. Agr. Ann. Rpt., 27 (1927), . 67–69, pl. 1*).—This is a brief report on the occurrence of and work with me of the more important insects of the year.

List of publications on Indian entomology, 1927 (*Agr. Research Inst., usa, Bul. 184 (1928), pp. 33*).—This compilation is in continuation of that ! the previous year (E. S. R., 58, p. 858).

Common garden pests: What they are and how to control them, C. T. REGORY and J. J. DAVIS (*Des Moines, Iowa: Better Homes and Gardens, 1928, p. 150, figs. 129*).—This is a practical account presented under the headings of ecognizing plant pests (pp. 7–17), enemies of garden flowers (pp. 18–79), awns (pp. 80, 81), ornamental shrubs and trees (pp. 82–108), and vegetables (pp. 109–139). An account of insecticides and fungicides is included (pp. 140–150).

[**Fruit insect control in Virginia**] (*Va. State Hort. Soc. Rpt., 33 (1928), pp. 129–136*).—The first of two papers presented at the annual meeting of the Virginia State Horticultural Society in December, 1928, is by W. S. Hough, and deals with the Delayed Dormant Spray (pp. 129–133). The second, by L. R. Cagle, is entitled The Oriental Fruit Moth (pp. 133–136).

Principles of forest entomology, S. A. GRAHAM (*New York and London: McGraw-Hill Book Co., 1929, pp. XIV+339, pl. 1, figs. 149*).—The several chapters of this work deal with the subject as follows: Introduction (pp. 1–15), historical review (pp. 16–24), biotic potential (pp. 25–31), environmental resistance (pp. 32–57), insect abundance (pp. 58–74), direct control of tree insects (pp. 75–85), direct control by chemical methods (pp. 86–98), indirect control of tree insects (pp. 99–115), other indirect control measures (pp. 116–135), leaf-eating insects (pp. 136–166), meristem insects of the terminal parts (pp. 167–180), meristem insects of the cambium region (pp. 181–197), cambium-wood insects (pp. 198–214), wood destroyers (pp. 215–244), sap-sucking insects (pp. 245–276), insectivorous parasites (pp. 277–293), and insectivorous predators (pp. 294–305). A bibliography arranged by chapters is included (pp. 306–317).

The composition of some commercial insecticides, fungicides, bactericides, rodenticides, and weed killers, compiled by H. J. FISHER and E. M. BAILEY (*Connecticut State Sta. Bul. 300 (1929), pp. 205–368*).—This is a compilation from State and Federal publications, the arrangement being in alphabetical order.

The preparation and use of oil sprays, J. R. EYER and R. F. CRAWFORD (*New Mexico Sta. Bul. 172 (1929), pp. 20, figs. 11*).—Oil sprays are recommended by the authors to replace sprays of lime sulfur in New Mexico, since they are cheaper, better to handle, and control equally well or better those insect pests for which lime sulfur was designed, particularly San Jose scale. Miscible oils and emulsion stocks used in making oil sprays and the hot and cold methods of emulsion stock preparation are discussed. The several kinds of oils and emulsifiers are reviewed and specifications given for the most reliable types. Red Engine oil is recommended as a reliable type to be usec for winter sprays, and Kayso and potash fish oil soap are advised as emul sifiers.

The results obtained during the past two years at the station in experi ments with oil sprays in commercial apple and peach orchards are briefi discussed. In both peach and apple orchard experiments practically 100 pe cent control was obtained from a delayed dormant application of 4 per cei Kayso oil emulsion. No injury to the trees was observed in either case.

Fish oil as an adhesive in lead-arsenate sprays, C. E. Hood (*U. S. Dept. Agr., Tech. Bul. 111 (1929), pp. 28, figs. 14*).—This is a revision of and supersedes Department Bulletin 1439, previously noted (E. S. R., 56, p. 658).

The Long Ashton tar-distillate wash: Field experiments, 1927–28, L. N. Staniland and C. L. Walton (*Jour. Min. Agr. [Gt. Brit.], 35 (1928), No. 8, pp. 731–740, pls. 2, figs. 2*).—Field tests were made of a tar-distillate wash known as the Long Ashton spray and a standard wash against the eggs of the apple sucker, winter moth, and capsid bug. The apple sucker was completely controlled by both 6 and 10 per cent strengths, and commercial control of the winter moth by both washes at 10 per cent strength. The 10 per cent strength standard wash brought about considerable reduction of capsid bug but did not give a commercial control such as was obtained by the use of the Long Ashton spray at the same strength. At the 6 per cent strength the Long Ashton spray was still found to be superior to standard wash, but in this case neither spray could be said to have given a satisfactory control.

Tests of the effect of tar-distillate spray drift on under crops showed that it should be taken into consideration.

A list of 15 references to the literature is included.

Tar-distillate winter washes and the apple capsid bug, S. G. Jary (*Jour. Min. Agr. [Gt. Brit.], 35 (1929), No. 10, pp. 917–921*).—Tar-distillate washes and the various combinations used in the experiments gave only a partial control of the apple capsid bug (*Plesiocoris rugicollis*), although the spraying was done more thoroughly than would be possible under commercial conditions.

Termites and termite damage, S. F. Light (*California Sta. Circ. 314 (1929), pp. 29, figs. 25*).—This is a practical account of termites, their damage and control, contributed by the Termite Investigations Committee, which was formed less than a year previous to publication as a cooperative effort between various industries concerned and the University of California.

Contribution to the study of the biology of the onion thrips, the causative agent of "ak-damar" or white veins of tobacco [trans. title], O. Perrin (*Rev. Tech. Monop. Tabacs Turquie, 1 (1928), No. 4, pp. 107–121*).—An account of the life history, economic importance, and means of combating this enemy of tobacco in Turkey.

Homoptera Palestinae I, H. Haupt (*Zion. Organ. Agr. Expt. Sta. Bul. 8 (1927), pp. 43, pls. 5*).—This account, in German, deals with the 55 forms occurring in Palestine. Five genera are erected, and 28 forms of Homoptera are described as new.

The Miridae of Ohio, S. A. Watson (*Ohio Biol. Survey Bul. 16 (1928), pp. 44, figs. 18*).—An account of the biological features of the Miridae, followed by accounts of the ecological aspects, habitat pictures, and economic species, and a general list of the Ohio species.

The chinch bug in relation to St. Augustine grass, R. N. Wilson (*U. S. Dept. Agr. Circ. 51 (1929), pp. 7, figs. 3*).—This is a practical summary of information on the chinch bug as a source of damage to St. Augustine grass in the extreme southeastern portion of the United States. It is pointed out that there are two forms of the adult chinch bug in Florida, the long-winged and the short-winged, and that these vary in relative numbers during the year. An account by Watson of the Florida Experiment Station of the injury to this plant by the chinch bug has been noted (E. S. R., 56, p. 555).

The greenhouse white-fly (Trialeurodes vaporariorum Westwood), E. R. Speyer (*Jour. Roy. Hort. Soc. 54 (1929), No. 1, pp. 181–192, pls. 9*).—Following a brief account of the life history of this insect, the author deals with artificial means of control, including fumigation with cyanide and with tetrachlorethane, recent modifications in cyanide fumigation, and biological control.

The Rhododendron white fly, G. F. WILSON (*Jour. Roy. Hort. Soc., 54 (1929), No. 1, pp. 214–217, pl. 1, figs. 2*).—This is an account of *Dialeurodes chittendeni* Laing, which is an important pest in the counties of Berkshire, Hants, and Surrey, England.

Biological and histological studies of Pieris brassicae [trans. title], . BERTOLINI (*Redia, 16 (1927), No. 1–2, pp. 29–39*).—This is a report of studies of the cabbage butterfly presented in connection with a list of 15 references to the literature.

The mystery of Alabama argillacea, G. N. WOLCOTT (*Amer. Nat., 63 (1929), No. 684, pp. 82–87*).—This discussion of the migratory habits of the cotton leaf worm is based upon personal observations in the United States, the West Indies, and Peru.

Developments in the corn-borer battle, W. P. FLINT, G. H. DUNGAN, and A. L. YOUNG (*Illinois Sta. Circ. 934 (1929), folder, fig. 1*).—This is a brief statement of the status of control work with the European corn borer.

Notes on the rice-borer, Chilo simplex, R. H. VAN ZWALUWENBURG, E. W. RUST, and J. S. ROSA (*Hawaii. Forester and Agr., 25 (1928), No. 3, pp. 79–82*).—This is an account of the pyralid moth *C. simplex* (Butl.), or possibly *C. oryzae* Fletch., which was first observed at Honouliuli, Oahu, in the fall of 1927, and has since been found on the island of Kauai. This pest, originally described from Taiwan (Formosa) and known in Japan as the two-brooded rice borer to distinguish it from an even more serious pest known as the three-brooded rice borer (*Schoenobius incertellus* (Walk.)), is considered to have been accidentally introduced into the Hawaiian Islands from Japan. Several natural enemies have been found preying on this form in the Hawaiian Islands, including *Trichogramma minutum* Riley; *Cremastus hymeniae* Vier.; *Polistes hebraeus* (Fab.); the ubiquitous lowland ant, *Phedole megacephala* (Fab.); the mynah bird, *Acridotheres tristis;* and an undetermined ichneumonid. No trace of rice borer has yet been found in sugarcane on Oahu, even when in close proximity to either standing or harvested fields of heavily infested rice.

New pine moths from Japan, C. HEINRICH (*Ent. Soc. Wash. Proc., 30 (1928), No. 4, pp. 61–64, figs. 5*).—Five species of moths, the larvae of which were injurious to young shoots of *Pinus thunbergii* in the vicinity of Yokohama, are described as new.

The use of oil for the destruction of mosquito larvae and pupae, J. McFARLAND (*Jour. Amer. Med. Assoc., 91 (1928), No. 25, p. 2014*).—A communication in which reference is made to a contribution dated August, 1793, recommending the use of any common oil for the destruction of mosquito larvae.

New Zealand Empididae, J. E. COLLIN (*London: Brit Mus. (Nat. Hist.), 1928, pp. VIII+110, figs. 27*).—Eighty-seven species representing 26 genera are described from New Zealand, of which 78 are new to science. Seven genera are erected.

Characters of the larvae and pupae of certain fruit flies, C. T. GREENE (*Jour. Agr. Research [U. S.], 38 (1929), No. 9, pp. 489–504, figs. 6*).—In this contribution the author describes and illustrates the distinguishing character of 10 of the more important native and exotic species of fruit flies. Keys for the identification of the larvae and pupae are given for the 10 species, followed by detailed descriptions of each and illustrations. These include lateral and posterior views of the larvae, their mouth hooks, lateral and posterior views of the pupae, and wings of the adults.

The species thus dealt with include the papaya fruit fly from the Canal Zone; the West Indian fruit fly, which feeds on numerous varieties of fruit from Panama; the Central American fruit fly (*Anastrepha striata* Schiner

which attacks guava, and the dark fruit fly (*A. serpentina* Wied.), both from Panama and the Canal Zone; the melon fly (*Bactrocera cucurbitae* Coq.) and the Mediterranean fruit fly, both from Hawaii; the olive fruit fly from Italy; the cherry maggot and the apple maggot, both from Ithaca, N. Y.; and the Mexican fruit fly (*A. ludens* Loew) from Mexico.

Control work with the olive fruit fly (Dacus oleae Rossi) [trans. title], A. Berlese (*Redia, 16 (1927), No. 1–2, pp. 111–125*).—This is an account of control work in 1926.

Experimental studies on the duration of life.—XII, Influence of temperature during the larval period and adult life on the duration of the life of the imago of Drosophila melanogaster, W. W. Alpatov and R. Pearl (*Amer. Nat., 63 (1929), No. 684, pp. 37–67, figs. 13*).—The author has found that this pomace fly reared at 18° C. is distinctly larger in a series of bodily dimensions than when reared at 28°. The pigmentation is different in the two cases, notably with reference to the pigmentation of the seventh tergum. Females were longer lived than males in all series of these experiments.

On the trail of destructive timber borer, M. B. Dunn (*Canada Lumberman, 49 (1929), No. 5, pp. 31, 32, figs. 2*).—This is a discussion of the problem of controlling the long-horned timber-boring beetles, particularly the small black beetle *Monochamus scutellatus* Say, known to lumbermen as the spruce bug, and the larger gray beetle *M. notatus* Drury, referred to as the pine bug. Both of these beetles are said to be abundant in nearly all parts of eastern Canada and their appearance familiar to those working in the woods or about lumberyards. Means of prevention include (1) the placing of logs in lake or river water, since immersion will kill the larvae within a few days, (2) cutting the logs and skidding soon after an early spring fire, (3) cutting during the winter after a late summer fire, (4) covering skidways with balsam brush; and (5) application to the skidways of lime-sulfur dust.

North American predacious insects attacking Japanese beetle grubs (Popillia japonica Newman), H. C. Hallock (*Ent. News, 40 (1929), No. 3, pp. 76–78*).—The author presents notes on a number of insect predators which have not been found numerous enough in the field to have any noticeable effect upon the Japanese beetle.

Potato beetle septicemia, with the proposal of a new species of bacterium, G. F. White (*Ent. Soc. Wash. Proc., 30 (1928), No. 4, pp. 71, 72*).—The name *Bacillus leptinotarsae* n. sp. is given to a new bacterium, the cause of a disease of the larva of the Colorado potato beetle.

The tiger beetles of Minnesota (*Minnesota Sta. Tech. Bul. 56 (1928), pp. 13, figs. 2*).—The biology of the tiger beetles is briefly considered by R. W. Dawson, who includes a key to the species of Minnesota tiger beetles. Notes and records on the tiger beetles of Minnesota, representing 26 forms, by W. Horn, follow.

A reclassification of the genera of North American Meloidae (Coleoptera) and a revision of the genera and species formerly placed in the tribe Meloini, found in America north of Mexico, together with descriptions of new species, E. C. Van Dyke (*Calif. Univ. Pubs. Ent., 4 (1928), No. 12, pp. 395–474, pls. 5*).—This revision includes descriptions of seven new forms, keys to the genera, keys for the separation of the species of the several genera, and a 4-page list of references to the literature. The genus Brachyspasta is erected.

The mint flea beetle (Longitarsus waterhousei Kutsch): Its habits and measures for its control, L. G. Gentner (*Michigan Sta. Circ. 125 (1929), pp. 4*).—This contribution supplements the data given in Special Bulletin 155,

previously noted (E. S. R., 55, p. 357). The species is now identified as *L. waterhousei* (E. S. R., 60, p. 655).

Several natural enemies of the species have been observed, including the ground beetle *Poecilus lucublandus* Say, which fed on live flea beetles, and a snipe fly, *Psilocephala haemorrhoidalis* Macq., the larvae of which feed on the beetle pupae. A small ground beetle, *Bembidion quadrimaculatum* L., and the ant *Lasius niger americanus* Emery were observed to feed on the soft parts of poisoned beetles.

It has been found that good control of the pest is obtained in conjunction with certain farm practices from the use of poison dusts, including a mixture of 20 lbs. of calcium arsenate and 80 lbs. of talc, one of 20 lbs. of calcium arsenate and 80 lbs. of calcium fluosilicate compound, one of 20 lbs. of calcium arsenate, 40 lbs. of talc, and 40 lbs. of calcium fluosilicate compound, and one of 5 to 10 lbs. of a fine dusting Paris green mixed with 95 or 90 lbs. of either cheap flour, talc, or calcium fluosilicate compound. Paris green gave the quickest kill, but must be used with care on standing mint because of its tendency to burn the foliage.

The genus Pityophthorus Eichh. in North America: A revisional study of the Pityophthori, with descriptions of two new genera and seventy-one new species, M. W. BLACKMAN (*N. Y. State Col. Forestry, Syracuse Univ., Tech. Pub. 25 (1928), pp. 5–183, figs. 124*).—This is a synopsis of a genus of great economic importance, containing more species in America north of Mexico than any other genus of American bark beetles.

An injurious Chinese nut curculio (Coleoptera: Curculionidae), F. H. CHITTENDEN (*Ent. Soc. Wash. Proc., 30 (1928), No. 4, pp. 69, 70*).—This is a description of *Curculio haroldi* Faust, found to infest chestnuts received in the United States from Hai-tong Range, Yunnan, China.

Control studies on the plum curculio in Connecticut apple orchards, P. GARMAN and M. P. ZAPPE (*Connecticut State Sta. Bul. 301 (1929), pp. 369–437, pls. 8, figs. 12*).—This is a report of studies commenced in 1923 and extending over a period of six seasons, most of the observations having been made at the station farm at Mount Carmel.

The authors have found the plum curculio to be responsible for much damage to apples in Connecticut. The pest is single brooded, and all attempts to produce eggs from the beetles emerging during the summer failed. The beetles were found to emerge from hibernation near the first of May, but did not appear in numbers on the trees until after the blossoms fell. They were found to come to the trees from outside sources in greatest numbers for a period of about 20 days, the peak of abundance and egg laying being reached near the middle of June, frequently the fifteenth but sometimes nearer the twentieth. It was found that the beetles developing in dropped apples may offer a serious menace to the succeeding crop.

Sprays applied according to successful schedules here outlined pile up the poison until the June peak of abundance is reached, after which there is considerably less danger. The beetles, however, continue on the apple trees in small numbers until the last of July. In control work conducted all attracting and repelling substances have failed to exert any influence on the curculio in the field, although capryl alcohol was a powerful repellent when the curculios were confined in cages. Laboratory tests indicated that the beetles are fond of sweets and may be poisoned in captivity by mixtures containing them.

"Effective poisons used in cage tests include (1) acid lead arsenate, (2) basic lead arsenate, (3) sulfur arsenate dust 90–10, (4) calcium arsenate, (5) ortho-zinc arsenite, and (6) sodium fluosilicate lime dust 1–4 . . .

Spray tests in three different orchards indicate: (1) That a fair degree of control may be secured with three sprays in Connecticut, but better control with four using a pink, calyx, 7-day, and 2-week schedule as outlined. (2) That occasionally a pink, calyx, 2-weeks, and 4-weeks schedule will give good control, while the omission of the 7-day and using fish oil and lead arsenate at the calyx period without lime sulfur closely approximates the results obtained with the four spray schedule, but is on the whole less uniform. Such a schedule should be valuable on trees that burn easily and are not subject to scab infection, besides being more economical than a 4-spray schedule. (3) That the most consistently good results have been obtained with the 4-spray schedule consisting of pink, 7-day, and 2-weeks applications. This resulted in an average of 94.2 per cent unmarked fruit for all tests. (4) There has been a gradual reduction in injured fruit since 1924, in the orchard where dropped fruits were collected and wild apples in the vicinity sprayed. (5) Basic lead arsenate compared with acid lead arsenate and used at the same rate per gallon gave less control of curculio than the acid form. It also allowed too much damage from canker worms to be practical at the rate used. (6) Sprays and dusts used in one field test in 1928 on a full schedule (pink, calyx, 7-day, and 2-weeks) showed the spray slightly superior in control but that dust has merit. This conforms in general with the Milford experiments of Stoddard and Zappe [E. S. R., 57, p. 160]. (7) Spray residues remaining on the fruit at harvest have been small enough in all cases to conform with the export tolerance."

Parasites of the curculio are not abundant in the State. *Triaspis curculionis* appeared to be the most so, although it did not kill over 33 per cent of the larvae obtained at any one time.

The work includes a list of more than 50 references to the literature.

Poisoning the cotton boll weevil, B. R. Coad and R. C. Gaines (*U. S. Dept. Agr. Leaflet 57 (1929), pp. 4*).—A practical account of control work by means of poisoning.

The feeding of bees, D. M. T. Morland (*Jour. Min. Agr. [Gt. Brit.], 35 (1929), No. 10, pp. 945–950*).—It is concluded that the prejudice among beekeepers against beet sugar has little or no foundation at the present time, and that the indiscriminate addition of drugs and disinfectants to bee sirup is unwise, since it is not known what effect they have on the inversion of the sugar.

Note on the occurrence of the mite Dermanyssus gallinae L. in the nest of a house wren, C. N. Ainslie (*Canad. Ent., 61 (1929), No. 2, pp. 39, 40*).—The author records the infestation of the nest of a house wren by the chicken mite, as observed at Sioux City, Iowa.

ANIMAL PRODUCTION

[Nutrition studies at the California Station] (*California Sta. Rpt. 1928, pp. 61, 62*).—A study of the development of internal organs as influenced by the quantity of protein in the ration was made with 2 groups of 6 rats each. One group received a standard stock ration and the other group the same feeds with the protein content doubled. Both groups were healthy and grew normally, and aside from hypertrophy of the kidneys in the high-protein group there was no significant difference in the development of the organs. Two other groups of rats fed on high- and low-protein diets, respectively, did not grow normally, the high-protein group having the slower rate of growth and being more unthrifty than the low-protein group. There was a relatively greater

development of the liver, pancreas, alimentary tract, kidneys, spleen, and suprarenals in the high-protein group, but no significant difference in the other internal organs.

The difference in the organ weights of twin does fed high- and low-protein rations from weaning time paralleled that of the rats with the exception that the doe receiving the high-protein ration also had the larger heart.

[Animal nutrition studies at the Iowa Station] (*Iowa Sta. Rpt. 1928, pp. 29, 30, 31, 46, 47*).—The results of three experiments, two of which have been continued (E. S. R., 59, p. 65), are reported.

Mineral requirement in animal nutrition.—Sodium fluoride fed at the rate of 0.025 per cent of a ration of corn, tankage, linseed meal, bone meal, and salt had a detrimental effect upon the teeth and bones. Calcium fluoride in such a ration did not affect the appearance, growth, or stability of the teeth and bones, even when fed at the rate of 0.05 per cent. Growth and reproduction failed on rations of wheat, limestone, and butterfat when calcium fluoride was fed at a level lower than 0.25 per cent, and teeth and bone defects were evident when fed at a level of 0.05 per cent. Bone flour was in general a better source of calcium than calcium carbonate when sodium fluoride was fed. Excessive calcium did not protect against fluoride injury when calcium fluoride was incorporated in the ration. Later generations of rats on high percentages of these fluorides made poorer records in growth and reproduction than did the first generation fed at the same levels.

Action of antirachitic vitamin.—Continuing the work with the antirachitic vitamin, it was observed that iron oxide or rust passed through the digestive tract reduced and black in a vitamin-deficient ration, but came through more or less unchanged and red when the vitamin was added. Antiseptics added to the ration containing the vitamin appeared to make it more effective. This indicates that the microorganic life of the intestinal tract may cause the unhealthy condition when animals are fed the vitamin-deficient ration. Further studies indicate that antiseptics in the intestinal tract definitely postponed rickets in animals on a deficient diet.

Metabolism tests with calves.—An effort was made to determine the nutritional limitations of milk alone and of milk supplemented with various feeds. A Holstein heifer that had consumed from 45 to 70 lbs. of milk daily became anemic, developed a depraved appetitie, and died at 19 months of age. While sexual maturity appeared to have been delayed, the animal had conceived at 18 months old.

A group of heifers fed cod-liver oil, bone meal, and iron citrate in addition to the milk became anemic and poor in condition, but a marked improvement occurred when alfalfa hay was added to the diet. Alfalfa hay and a very limited amount of milk did not furnish sufficient nutrients for young calves, but when changed to a milk ration such calves made more rapid live weight and skeletal growth.

[Investigations with sheep at the California Station] (*California Sta. Rpt. 1928, p. 62*).—In a study of rations for fattening sheep 6 lots of 40 lambs each were fed as follows: Lot 1 whole barley and alfalfa hay, lot 2 whole barley and cottonseed meal 8:1 and alfalfa hay, lot 3 whole barley and cottonseed meal 4:1 and wild oat hay, lot 4 same as lot 3 with the addition of calcium carbonate, lot 5 whole barley and cottonseed meal 6:1 and alfalfa and wild oat hay equal parts, and lot 6 same as lot 4 with the addition of molasses.

The average daily gains in the first 5 lots were 0.285, 0.267, 0.189, 0.18, and 0.157 lb. per head, respectively. In lot 6 it was planned to feed chopped wild oat hay mixed with molasses, but the lambs refused this feed and after

2 weeks long hay was fed. Unsatisfactory gains were made on this ration throughout the test. This work indicates that there is no advantage in adding cottonseed meal to a barley-alfalfa hay ration, that alfalfa hay is superior to wild oat hay, that nothing is gained by adding calcium carbonate to wild oat hay, and that feeding the two hays mixed in equal parts had little advantage over wild-oat hay for fattening lambs.

[Experiments with beef cattle at the California Station] (*California Sta. Rpt. 1928, pp. 60, 61*).—In studies with yearling steers it was found that when a ration of wild oat hay and rolled barley was supplemented with enough cottonseed meal to furnish an amount of protein equal to a ration of alfalfa hay and barley, the former ration was equal to the latter in producing gains and finish. Adding finely ground oyster shells to the rolled barley, cottonseed meal, and wild oat hay ration, or cottonseed meal to the rolled barley and alfalfa hay ration did not improve their value. Molasses substituted for part of the barley and fed with chopped wild oat hay increased the feed consumption and reduced the waste of hay, but did not produce any better gains or finish than long wild oat hay. The feeding of equal parts of the two hays was no more efficient than either hay alone.

Cattle made approximately the same gain on Sudan grass and alfalfa pasture. Check plats clipped at 28-day intervals showed that alfalfa yielded the larger amount of dry matter.

An analysis of forage samples from a section of the State where the cattle showed an apparent mineral deficiency during 1926 showed a low phosphorus and calcium content. Bur clover, which is fairly high in both elements, made an abundant growth during 1927, and the cattle maintained excellent condition, with a fairly high calf crop in 1928.

[Experiments with sheep at the Indiana Station] (*Indiana Sta. Rpt. 1928, pp. 33, 34, fig. 1*).—Results of two experiments are noted.

Grass makes good lambs.—The rate of gain and the finish of the lambs was practically the same when ewes and lambs were fed a good ration without pasture, when the lambs were on a good ration in dry lot and the ewes on pasture, when ewes and lambs were on pasture with lambs fed grain in creeps, or when ewes and lambs were on pasture with no additional feed.

Oats a profitable feed.—In studies with lambs and cattle it was found that oats should be used as a substitute rather than as a supplement to corn for ruminant animals.

Iodine requirements of sheep (*Iowa Sta. Rpt. 1928, pp. 22, 30, 31*).—During the winter months 4 groups of 10 ewes each were fed a standard basal ration. In addition iodine supplement was fed in the respective groups as follows: No supplement, 0.05, 0.2, and 0.8 grain of iodine per head per day during pregnancy. The thyroids of the lambs yeaned by these ewes increased in size as the iodine dosage decreased, and the iodine content of the glands was higher in the lots fed iodine supplement.

The average percentage of thyroidal iodine in the glands of the lambs for a period of 3 years, as presented in these brief notes, was lot 1 0.33, lot 2 0.64, lot 3 0.55, and lot 4 0.63. In lots where no iodine was fed the ratio of the weight of thyroidal iodine to the weight of the lamb was about 1 to 6,000,000 and in the lots where the iodine was fed about 1 to 3,000,000. It was estimated from these results that 0.05 grain of potassium iodide per ewe per day was sufficient to protect against iodine deficiencies.

[Swine investigations at the California Station] (*California Sta. Rpt. 1928, p. 65*).—Studies with Duroc-Jersey and Poland China pigs weighing 50 to 75 lbs. indicated that when fed barley and salt or brewers' rice and salt either in the presence or absence of direct sunlight, symptoms of rickets developed. Pigs

fed barley and calcium carbonate in the absence of sunlight developed rickets, while on the same ration in sunlight they remained normal. Three sows were maintained during their gestation period on barley, tankage, and chopped alfalfa in the absence of sunlight, and the pigs farrowed were kept under the same conditions. At weaning time these pigs had developed rachitic symptoms, and at four months of age their legs were deformed.

[Experiments with hogs at the Indiana Station] (*Indiana Sta. Rpt. 1928, pp. 33, 34, 35, 36, 57, fig. 1*).—The results of some experiments in continuation of those previously noted (E. S. R., 59, p. 765) are reported.

Mineral deficiencies of soybeans in livestock feeding.—Hogs fed a mineral mixture of limestone dust, steamed bone meal, and salt 10: 10: 1 in conjunction with a basal ration of corn and soybeans made larger gains, and the strength of bone was greater than in lots where no minerals were fed. When steamed bone meal was used as a source of phosphorus the average load required to break the femur bone was 1,044 lbs., when superphosphate was fed 990 lbs., rock phosphate 865 lbs., and no minerals 759 lbs. In tests with rats there was a greater response to variations in protein constituents than in the mineral content of rations, indicating that improvements in a corn and soybean ration should include protein as well as mineral corrections.

Swine efficiency test.—Studies with 435 carcasses from 49 ton litters again showed that the percentage of wholesale cuts depends largely upon the relation between the thickness of fat and lean rather than on the length of the animal. Animals that did not show excessive thickness of fat were necessary to secure a large proportion of lean cuts, but in some of the carcasses the lack of thickness was also accompanied by soft fat.

Soybeans not an adequate supplement for fall pigs.—Adding small quantities of alfalfa meal and certain high-protein feeds increased the efficiency of a ration of soybeans and corn. Fish meal was better than tankage or dried buttermilk as a supplement to this ration. A ration composed of corn, tankage, alfalfa meal, and linseed meal gave the best results with fall pigs, while a ration of corn, wheat shorts, and tankage also produced satisfactory results.

Low protein tankages of high feeding value.—Reduction tankage made from dead animals and 35 per cent protein tankage from small packing plants were practically equal to 60 per cent protein tankage as supplements to corn for hogs on alfalfa pasture. McCullough-process garbage was inferior to tankage for producing gains, but from the standpoint of economy was very satisfactory.

Gains in hogging down corn.—On a ration of standing corn and tankage pigs averaging 130 lbs. at the start gained 53 per cent more rapidly than hogs averaging 100 lbs. On a ration of standing corn and soybeans and a mineral mixture the heavier hogs gained 67 per cent more rapidly than the lighter animals.

Sows on good rations save more pigs.—Sows on a ration of corn, oats, and tankage raised 76.7 per cent of the pigs farrowed, those on corn and oats raised 72 per cent, and those on corn alone 66.3 per cent. Mature sows in medium condition and with liberal exercise have produced satisfactorily on corn alone, but for gilts this ration was quite unsatisfactory.

Trucking hogs to market is increasing.—In 1927 more than 47 per cent of the hogs received at the Indianapolis market were trucked in. The average death loss over a period of 4 years for trucked-in hogs was 0.88 per 1,000 as compared with 1.57 per 1,000 for hogs shipped in by rail. Crippled losses were 1.59 per 1,000 for trucked-in hogs and 3.04 per 1,000 for hogs shipped by rail.

Anemia in pigs.—Pigs suffering from anemia were not benefited by the feeding of liver meal or liver extracts, nor did vitamin extracts prevent anemia.

[Investigations with swine at the Iowa Station] (*Iowa Sta. Rpt. 1928, pp. 20–22, 48, 49*).—Results of several experiments are noted.

Superior supplementary mixtures for the feeding of growing and fattening pigs on pasture.—In this study 17 groups of pigs were fed various supplementary mixtures in dry lot and on pasture. Pigs self-fed corn, tankage, and mineral mixture on a bluegrass-alfalfa pasture made somewhat more rapid and economical gains than those fed the same ration on rape pasture. When 40 per cent of the tankage was replaced by linseed meal, pigs required less time to reach market weigh and less feed per unit of gain than the check group receiving tankage. Substituting a like amount of cottonseed meal resulted in increasing both the time required to reach market weight and the feed per unit of gain. Pigs receiving 40 per cent of coconut oil meal in place of a like amount of tankage made slightly more gain at less cost than those receiving tankage. On a supplement of tankage, linseed meal, and cottonseed meal 60 : 20 : 20, pigs consumed more feed and made more rapid gains than those receiving the tankage-linseed meal combination.

Pigs fed whole, ground, or dehulled oats in addition to a limited amount of corn, with a full feed of corn for the last 60 days, made fairly satisfactory gains. The whole oats made the best showing of the oat-fed groups. Grinding and dehulling, particularly the latter, increased feed consumption but also increased the cost. Shelling and cracking corn and mixing it with ground oats was relatively unprofitable. Pigs in dry lot made on the average better gains than those on pasture, but more of the high-priced supplementary feeds were required in dry-lot feeding.

Substituting alfalfa-leaf flour for alfalfa meal from whole hay did not increase the rate or decrease the feed requirements, but did increase the cost of gains. Meal made from very stemmy hay was unsatisfactory as compared with the regular meal.

Studies of different breeding systems with swine.—Continuing this study (E. S. R., 59, p. 67) there was little difference in the birth weights of purebred, three-fourths-bred, and crossbred Duroc-Jersey and Poland China pigs. The crossbreds outgained the purebreds during the suckling and fattening periods, and both outgained the three-fourths bred. These latter pigs lacked uniformity when they reached market weight.

Type tests with swine.—From weaning at 50 days to 225 lbs. live weight, big-type pigs made more rapid gains than did medium-type pigs. The feed required per unit of gain, however, was in favor of the medium-type pigs, particularly since they required less of the expensive protein supplement.

[Horse studies at the California Station] (*California Sta. Rpt. 1928, p. 60*).—Samples of semen from two stallions fed a ration low in calcium and phosphorus were collected at intervals and examined under the microscope. The work so far indicates that the deficient ration is accompanied by a decrease in the motility and by a decided decrease in the number of spermatozoa present.

A comparison of an alfalfa, oats, and corn ration with timothy, oats, and corn for work horses (*Iowa Sta. Rpt. 1928, p. 23*).—According to this brief note, the same grain ration was fed to 3 teams of work animals (4 mules and 2 horses), and 1 animal in each team received alfalfa hay, while the other received timothy hay. At the end of a feeding period the hays were reversed. With the exception of 1 animal the average gain on alfalfa hay was 17.5 lbs., and with the exception of 1 animal the loss on timothy hay was 28.08 lbs. per head. The hair coats of the animals fed alfalfa hay were in better condition that those fed timothy.

[Poultry investigations at the California Station] (*California Sta. Rpt. 1928, pp. 98, 99*).—On a ration which included 2 per cent of dried yellow carrots as the sole vitamin A supplement, 17 birds had an average production of

151 eggs. On the same ration except that the carrots were omitted, 1 bird showed vitamin-deficiency symptoms after 3 months feeding, 2 after 4 months, and 1 after 6 months. The yolks of the eggs produced in the lot receiving carrots were very pale.

Preliminary work indicates that in balanced rations grain proteins are little used by poultry.

Effects of early handicaps on chickens as measured by yolk absorption and body weight to twenty weeks of age, S. L. PARKER (*Hilgardia [California Sta.], 4 (1929), No. 1, pp. 56, figs. 14*).—The results obtained in a study of yolk absorption in baby chicks are summarized as follows: (1) Early handicaps, including poisons, starvation, and high and low temperatures, did not change materially the course of yolk absorption; (2) these handicaps, together with the removal of the unabsorbed yolk at 1 day of age, failed in general to have a permanent effect on body weight; (3) doses of mercuric chloride had more effect on body weight than any other handicap; (4) a more permanent effect due to the removal of unabsorbed yolk, starvation, and doses of nicotine sulfate and arsenic trioxide was noted with males than with females; (5) there was no consistent correlation between day-old weight and weight at 20 weeks of age; (6) there was a significant correlation between day-old weight and weight of yolk sac up to and including 5 days of age; (7) mortality tended to eliminate the chicks with the smaller day-old weights up to 20 weeks of age; (8) chicks that died had larger unabsorbed yolks than survivors at the same age; and (9) the mortality rate was the same for both sexes up to 20 weeks of age.

[Experiments with poultry at the Indiana Station] (*Indiana Sta. Rpt. 1928, pp. 53–57, figs. 3*).—Some experiments, most of which have been continued (*E. S. R., 59, p. 769*), are noted.

Soybean protein satisfactory for growing chicks.—Soybean oil meal was fairly satisfactory and a marked improvement over ground soybeans as a protein supplement for growing chicks. Ten per cent of protein from meat scraps was superior to 15 per cent of protein from either of the soybean products, but good growth was obtained when 10 per cent of protein from soybean oil meal was supplemented with 6 per cent of protein from meat scraps. Neither ether extracting nor cooking ground soybeans seemed to improve their value, and increasing the mineral content of the basal ration also failed to improve their value.

Combinations of meat scraps and dried buttermilk.—A combination of 12 per cent of meat scraps and 4 per cent of dried buttermilk as a protein supplement for growing chicks during the first 8 weeks produced a gain of 1 lb. or more. Larger amounts produced larger gains in some cases, but the above combination was about the practical minimum.

Protein requirements for growing pullets.—During the growing period from 10 to 23 weeks of age 3 groups of pullets were fed the same basal ration, except that 7.5, 4.5, and 1.5 per cent, respectively, of meat scrap protein was added. Growth was in direct proportion to the amount of animal protein fed. At the end of the test, group 1 averaged 0.2 lb. more than group 2 and 0.5 lb. more than group 3.

Cod-liver oil stearin contains vitamin D.—Stearin extracted from cod-liver oil of high vitamin D potency appeared to be as good a source of the antirachitic factor as the cod-liver oil from which it was extracted.

Is germinated oats necessary?—Two years' study with ordinary laying rations, with and without germinated oats, indicated that this feed did not

produce any significant gain in egg production or hatchability nor bring about an increase in food consumption.

Is the all-mash method practical for layers?—A comparison of the all-mash and grain and mash methods of feeding birds over a period of 3 years showed that egg production, hatchability, and mortality were approximately the same with either method. The expense of grinding feeds for the all-mash ration makes it uneconomical for mature birds, but the method is preferable for young stock.

Winter sunshine provides vitamin D.—A third year's results confirm previous conclusions that winter sunshine supplies ample antirachitic vitamin and that nothing is gained by feeding cod-liver oil.

Turkey experiments.—Poults hatched during September and October gained as well as those hatched at the normal season and some of these began laying at 30 to 35 weeks of age. A flock on limited range fed grain and mash consumed 138 lbs. of feed and laid 62 eggs per bird from January 1 to October 1.

Corn and soybeans are not a complete ration.—The addition of protein and vitamin B carrier improved a ration of corn, soybeans, and minerals for chickens.

Soybeans as a source of protein for chicks.—Chicks made good growth on rations containing 15 to 20 per cent of protein from soybean oil meal. Soybean oil meal produced in a factory equipped with an Anderson expeller was superior to meal made by solvent extraction in the laboratory.

Red corn contains vitamin A only when it has a yellow endosperm.—Red corn with yellow endosperm prevented ophthalmia in rats, while red corn with white endosperm from the same ear contained no vitamin A. The red pericarp appeared not to influence the feeding value of the corn.

[Experiments with poultry at the Iowa Station] (*Iowa Sta. Rpt. 1928, pp. 24–26*).—Results of several experiments are noted.

Correlation studies with egg production.—Continuing these correlation studies (E. S. R., 57, p. 569) with 92 White Plymouth Rocks, it was found that the number of days to maturity had practically no relation to the date of hatch, fertility, hatchability, or rate of egg production but did show a high correlation with total annual production. The date of hatch did not affect fertility, hatchability, or rate of production, but hatching in March, April, and May affected to some extent the total number of eggs produced. Fertility had an insignificant correlation with rate of production, but a high correlation and a high partial regression coefficient with hatchability. Other partial regression coefficients were found to be low. Rate of production slightly affected hatchability and total production, while total production had an insignificant correlation and hatchability. The coefficient of multiple correlation, 0.38 ± 0.07, indicated that the variables selected influenced hatchability.

The effect of moisture on hatchability of eggs.—A total of about 14,000 eggs were weighed at the beginning of incubation, the losses in weight calculated on the sixth, twelfth, and eighteenth day of incubation, and the weight of chicks determined at 24 to 48 hours after hatching. The average weight lost in forced draft incubators was 15 per cent. In the rotary circulation type of incubator the highest percentage of eggs hatched were from eggs with a weight loss of from 9.5 to 10,5 per cent for brown eggs and 9.5 to 11.5 per cent for white eggs.

Rations for chicks.—In a study with 50 lots of 25 chicks each fed a basal ration of corn, it was found that adding 3 per cent of a mineral mixture composed of calcium carbonate, bone meal, and salt over an 8-week period doubled the gains over the check lot receiving no minerals. Milk in some form was

essential for proper growth and development, and the most economical growth was made when animal proteins from milk and meat sources were added to the ration. A variety of animal and vegetable proteins was necessary for efficient growth.

Rations for hens.—In an effort to find efficient and economical rations for egg production, 12 pens of hens were fed varying rations. It was found that yellow corn was superior to white corn. Adding milk to a corn, wheat, and oats ration increased production from 42 to 143 eggs per bird, and the further addition of minerals increased the production to 187 eggs. Salt, calcium carbonate, bone meal, and charcoal were the most important minerals for laying hens, and calcium as carbonate appeared to be the only form in which hens could use it for making egg shells.

Air requirements of poultry.—In this study it was found that the purity of the air had little effect on the health of laying birds, but that drafts produced colds and other discomforts. When a complete ration was fed, confinement had no detrimental effect upon production, and the shell texture and strength of eggs from hens receiving cod-liver oil were as good as those of hens kept in sunlight.

Chick suggestions, C. S. Platt (*New Jersey Stas. Hints to Poultrymen, 17 (1929), No. 5, pp. 4, fig. 1*).—Suggestions are presented as to the important facts to be kept in mind in growing pullets. Schedules for the care, management, and feeding of chicks and suggestions for battery brooding are also presented.

Report of the New Jersey egg-laying contests, November 1, 1927–October 23, 1928, W. C. Thompson (*New Jersey Stas. Hints to Poultrymen, 17 (1928), No. 3, pp. 4, fig. 1*).—A report of the twelth year of the Vineland egg-laying contest and the eighth year of the Bergen County egg-laying contest (E. S. R., 58, p. 468).

Egg production, monthly costs, and receipts on New Jersey poultry farms, November, 1927–October, 1928, L. M. Black (*New Jersey Stas. Hints to Poultrymen, 17 (1929), No. 4, pp. 4, fig. 1*).—The eighth year's report of this work carries the summary of the monthly records of 27 representative flocks (E. S. R., 58, p. 869).

Report on the seven-point program, J. C. Taylor (*New Jersey Stas. Hints to Poultrymen, 17 (1929), No. 6, pp. 4, fig. 1*).—The results of a campaign in which was outlined 7 points based on sanitation in an endeavor to reduce mortality in raising day-old chicks are presented. With 230 poultrymen throughout the State who reported on this campaign, the average mortality was 18.6 per cent. The mortality for those who followed all 7 points was 14.2 per cent, for those who followed 4 points 17.2 per cent, and for those where only 1 or 2 points were followed 20 per cent.

DAIRY FARMING—DAIRYING

[Experiments with dairy cattle at the California Station] (*California Sta. Rpt. 1928, p. 65*).—Continuing the study of the relation of flies and fly sprays to milk production (E. S. R., 57, p. 273), it was found that exposing high-producing cows to a heavy infestation of house flies had no effect on production. In the absence of flies, sponging with water had no effect on production, but spaying with water, with pine tar creosote, and with oil caused losses of 5.4, 6.9, and 9.7 per cent, respectively, in production. During the last 2 weeks of spraying the losses with pine tar creosote and oil were 12.5 and 22.8 per cent, respectively. Body temperatures were as much as 3° F. higher in the oil-sprayed group and the respiration rate 40 per cent greater than in the control group.

[Experiments with dairy cattle at the Indiana Station] (*Indiana Sta. Rpt. 1928, p. 41*).—Three experiments are noted in continuation of those previously reported (E. S. R., 59, p. 772).

Grinding feeds for dairy cattle.—Grinding to medium fineness proved the most satisfactory method of preparing grain for dairy cows. When fed with grain and silage it was found uneconomical to grind either alfalfa or soybean hay.

Supplementary feed for cows on pasture.—Supplementing pasture with grain or grain, hay, and silage helped to maintain the body weight of medium-producing cows, but did not affect milk production significantly when the pasture was good.

Winter dairy heifers.—A group of 5 heifers confined for 150 days after November 7 in a closed shed gained less in body weight but more in height at withers than a similar group fed the same ration but kept in an open shed.

Minerals in dairy cattle feeding (*Iowa Sta. Rpt. 1928, p. 23*).—Continuing this study (E. S. R., 59, p. 72), heifers fed minerals from birth to 18 months of age gained an average of 27 lbs. more than those receiving no minerals. Of the heifers, those whose dams had received minerals gained 49 lbs. more than those whose dams had received no minerals. Of the heifers fed no minerals, those whose dams had received minerals gained 31 lbs. more than those whose dams had received no minerals. These results indicate that feeding minerals to the dams had a slight effect upon the rate of growth but no effect upon the birth weight of calves.

Raising the dairy calf, I. W. RUPEL (*Wisconsin Sta. Bul. 404 (1929), pp. 23, figs. 11*).—The first part of this publication is a popular discussion of the care and management of dairy calves.

In the feeding tests reported in the second part it was found that when a liberal allowance of skim milk was fed an ample supply of protein was furnished the calves, and when legume hay was fed in addition to the skim milk farm-grown cereal grains could be used extensively in the growing ration. When no skim milk was fed and whole milk limited to 400 lbs. per calf from birth, good growth was obtained, and heifers so raised made desirable replacement animals. Whey was found to be a valuable feed for dairy calves in sections where it was available. While animals fed whey did not gain as rapidly as those fed skim milk, very satisfactory growth was produced on this feed. Feeding semisolid buttermilk gave fairly satisfactory results, but it was not as economical as skim milk. Dried skim milk was practically equal to liquid skim milk but was quite expensive when fed in large quantities. Various calf gruels (E. S. R., 59, p. 73) produced satisfactory results but required warm water for mixing. Water was found to promote growth by stimulating the appetite and thus increasing the consumption of feed.

[Studies in dairying at the Indiana Station] (*Indiana Sta. Rpt. 1928, p. 41*).—Two experiments are noted.

Ice cream studies.—During the first 60 days of storage it was found that the number of bacteria in ice cream decreased about 65 per cent and then gradually increased. The bacteria which ferment lactose were predominant during the storage period.

Washing and sterilizing milking machines.—In this study the most practical and efficient method of cleaning milking machines was to rinse in cold water immediately after use and then in hot water, to fill the teat cups and milking tubes with sodium hypochlorite 200 parts per million of chlorine, and to wash the head and pail in hot water in which hypochlorite at the rate of 40 parts per million was added. Rinsing the rubber parts with a hypochlorite solution was not an efficient method of sterilizing as an exposure of 30 minutes to the

chemical was needed. Sucking hot and cold water through the machine once or twice daily with a thorough cleaning once a week gave high bacterial counts. The average contamination of milk varied from 3,000 to 5,200,000 per cubic centimeter with these methods.

The casein-splitting ability of dairy starters [trans. title], C. Barthel and W. Sadler (*Meddel. Centralanst. Försöksv. Jordbruksområdet* [*Sweden*], *No. 343* (*1928*), *pp. 9*).—Studies at the Central Agricultural Experiment Station, Sweden, showed that during two months at room temperatures commercial and other starters did not form any more soluble nitrogen in chalked sterilized milk than did pure cultures of strains of lactococci isolated from the starters. The starters, however, split off larger amounts of amino acids than did the pure strains of organisms. This work emphasizes the importance of lactococci in cheese ripening, since starters are used for introducing lactic acid bacteria into the cheese milk.

The amount of salt and the influence of the method of salting upon changes in cheese [trans. title], E. Haglund, A. Silfversparre, and E. Sandberg (*Meddel. Centralanst. Försöksv. Jordbruksområdet* [*Sweden*], *No. 334* (*1928*), *pp. 21; Eng. abs., pp. 20, 21*).—In these studies half of the curd was salted as soon as the whey was drained and before the curd had matted. This is the usual manner of salting several types of Swedish cheeses. All the curd was placed in hoops and pressed for two days, after which the unsalted curd was salted in a brine bath. The bacterial and milk sugar content and the pH value of the cheeses were determined at varying intervals.

It was found that salting immediately after the whey was drained retarded the growth of bacteria, and bacteria in such cheeses developed more slowly than in cheeses not salted for two days. The percentage of milk sugar and the pH value decreased much more slowly in the former than in the latter cheeses. When 4 per cent or more of salt was present in the moisture of cheeses salted immediately, the body of the cheese was hard, brittle, and crumbly. Cheese that was not salted for two days could stand 8 per cent of salt in the cheese moisture without influencing its body to any appreciable extent.

Further studies were conducted in which half the curd was salted immediately after the whey had been drained off, while the other half was allowed to stand three hours before salting. This variation in the method of salting brought about differences in the cheeses similar to those noted above.

High heat treated skim milk gives ice cream a preference, O. E. Williams (*Ice Cream Rev., 12* (*1929*), *No. 7, pp. 54, 55, 138, fig. 1*).—Based on reports from three different experiments representing 105 individual judgments, the U. S. D. A. Bureau of Dairy Industry found that 63 per cent preferred the ice cream made with dried skim milk which had been prepared from milk forewarmed to 181.4° F. for 30 minutes. In comparison, about 37 per cent preferred ice cream made with dried skim milk prepared from milk forewarmed to 145.4° for 30 minutes. A preference of 63.2 per cent in favor of dried skim milk which had been subjected to high heat was shown in comparison with another dried skim milk which had not been heated to such a high temperature.

VETERINARY MEDICINE

[Report of work in veterinary science at the California Station] (*California Sta. Rpt. 1928, pp. 109–111*).—Experiments conducted with the university dairy herd have demonstrated that the resistance to *Brucella abortus* infection conferred by vaccination with live cultures will persist in certain cases for at least three regular gestation periods. The subcutaneous vaccination of calves against tuberculosis by the use of Calmette's bile-treated culture of tubercle

bacilli (B. C. G.) has shown that sufficient protection is afforded to prevent fatal tuberculosis from the intravenous injection of virulent cultures, but that the resistance is not sufficient to prevent the persistence of the living bacilli in the body. The resistance to feeding infection is not sufficient to prevent the penetration of and localization in the digestive tract by virulent tubercle bacilli and the production of caseous or caseocalcareous lesions in the lymph nodes of the mesenteric or cervical regions. In general, the lesions in the vaccinated cattle were less extensive and smears contained fewer acid-fast bacilli than did the lesions in the nonvaccinated animals.

In extensive inoculations upon various culture media of tissues from 27 head of cattle affected with lymphangitis or so-called skin tuberculosis, in studies by J. Traum, no tangible results were obtained. The autopsies thus far made of animals injected with these lesions failed to show any evidence of tuberculosis or other disease, although some of the lesions contained large numbers of acid-fast bacteria.

A vaccine which gives protection to pigs susceptible to hog cholera was developed by W. H. Boynton.

Encouraging results were obtained in the production of immunity to canine distemper by the use of a vaccine prepared from the parenchymatous tissues of infected dogs. In an investigation of an apparently new type of pneumonia in swine conducted by Boynton, a bacillus was isolated which is believed to be the cause of the disease, and an aggressin was developed which appeared to give some protection.

Fowl pox vaccine prepared by the method described by Beach (E. S. R., 58, p. 579) is said to have given satisfactory results, particularly in the immunization of pullets and cockerels. An extensive study of infectious bronchitis of fowls failed to develop any effective means of preventing or controlling the disease. The evidence obtained suggests that the causative organism is a filtrable virus. In further studies of *Bacterium pullorum* (E. S. R., 59, p. 775) it was observed that the infection may readily spread among adults by the association of noninfected with infected hens without the presence of males. In control work with fowl typhoid and roup in pigeons apparently good results were obtained from the use of autogenous bacterin.

[Report of the department of veterinary science at the Indiana Station] (*Indiana Sta. Rpt. 1928, pp. 61–64, figs. 2*).—Reference is made to the study of anemia in pigs, an account of which by Doyle, Mathews, and Whiting has been noted (E. S. R., 58, p. 280). The susceptibility of anemic pigs to necrobacillosis was shown by the injection of a normal salt solution containing macerated necrotic tissue from a case of bullnose in the pig into the subcutaneous tissue of the snouts and ears of three anemic and three nonanemic pigs. Typical bullnose and sloughing of the tissues developed in the anemic pigs. A local inflammation accompanied by swelling which disappeared in three days was the only lesion that occurred in the nonanemic pigs.

In four outbreaks of meningo-encephalitis in pigs the death rate in different herds ranged from 5 to 70 per cent. Microscopic sections of the central nervous system showed a well-marked round cell infiltration of the cerebrospinal meninges and of the brain and spinal cord.

Three cows were fed live cultures of *Bacterium abortus*, and the organism was isolated readily from the milk of one cow, the titer of her blood serum and milk remaining at a constant high level throughout the year. The titer of the blood serum and milk of the two cows that did not eliminate the organism in the milk showed considerable fluctuation.

Assistance was given in the investigation of an outbreak of undulant fever in a group of 15 students in a small college which resulted from the drinking

of raw milk from a dairy in which 30 per cent of the cows were affected with *B. abortus*. The organism was isolated from the milk of three cows in the herd and proved to be a highly virulent strain.

Several cases of paralysis in chickens in which the symptoms and gross lesions were similar to those of transmissible paralysis were met with in a few flocks of young birds, but the microscopic examination of affected nerve trunks showed a clearly defined difference between the two conditions. In the cases mentioned, there was an edema of the nerves only, while in transmissible paralysis there is an infiltration of the affected nerves by mononuclear cells. Birds affected with the edematous type of neuritis quickly recovered when placed on a diet of corn germs.

A number of chickens were vaccinated in the skin of the leg with unattenuated chicken pox virus, and none developed any symptoms of pox or roup following pen exposure to the disease or inoculation of the comb with pox virus.

Studies were made of the pathology of bacillary white diarrhea in chicks, a bulletin on which by Doyle and Mathews has been noted (E. S. R., 60, p. 76).

Agglutination tests to the number of 3,437 were made for infectious abortion, of which 2,237 were negative, 835 positive, and 331 suspicious.

A brief reference is made to the post-mortem examination of 4,823 animals in 1,655 flocks and herds.

[Report of Health of Animals Branch of Canada], W. R. MOTHERWELL (*Canada Min. Agr. Rpt. 1927–28, pp. 41–47*).—A report upon the occurrence and control of infectious diseases of livestock.

The health and nutrition of animals (*Aust. Council Sci. and Indus. Research Pamphlet 10 (1929), pp. 76*).—This is a report of observations on animal health problems made during a stay of six months in Australia by A. Theiler (pp. 9–64), followed by a memorandum on research in nutrition by J. B. Orr (pp. 65–76) based upon observations made during a shorter period. The third part of the report by Theiler deals with the Australian problems in animal health under the headings of diseases due to microorganisms, parasitic infestation, intoxications, deficiency diseases, diseases the causes of which are as yet unknown or not confirmed, the healthy animal, and genetics. The fourth part is devoted to a discussion of the problems and the organization under the headings of classification of the problems, the organization, problems proposed for early investigation, facilities for research, etc.

Administration report of the Government veterinary surgeon for 1927, G. W. STURGESS (*Ceylon Govt. Vet. Surg. Rpt. 1927, pp. 21, pls. 15*).—This report (E. S. R., 58, p. 72) includes an extended account of osteitis fibrosa, with special reference to mineral deficiency in foods (pp. 4–12). Young horses are said to be more susceptible than older ones, the majority of cases occurring in horses under 7 years of age, but cases are also seen in horses up to 16 years of age. Although cases of the disease in its typical form are seldom seen in Ceylon except in horses, the author has observed typical bone changes in a milch cow.

It is concluded that the disease occurs when every possibility of infection by contact has been prevented. Horses fed on diets containing minimum quantities of calcium and heavy excess of phosphoric acid develop the disease, which increases in severity in direct relationship with the excess of phosphoric acid. Horses fed on a diet in which phosphoric acid does not greatly exceed calcium do not develop the disease, although in intimate contact with affected animals.

Report of the chief veterinary surgeon for the year 1927, J. M. SINCLAIR (*South. Rhodesia, Chief Vet. Surg. Rpt. 1927, pp. 9*).—This is a brief

report (E. S. R., 58, p. 171) of the occurrence of and work with diseases of livestock during the year, particularly African coast fever.

[Contributions to veterinary medicine] (In *Proceedings of 3. Pan-Pacific Science Congress, Tokyo, 1926.*) [*Tokyo: Natl. Research Council of Japan*], *1928, vol. 2, pp. 2623–2678, figs. 6*).—The contributions presented at the Third Pan-Pacific Science Congress, held at Tokyo, October 30 to November 11, 1926, include the following: Contributions to Biological Studies on the Virus of Contagious Pleuro-pneumonia in Cattle (pp. 2623–2635), and On the Practical Value of Several Serological Reactions for the Diagnosis of Contagious Pleuro-pneumonia in Cattle (pp. 2636–2653), both by N. Nakamura, H. Futamura, and T. Watanuki; The Etiological Relationship between Small-pox and Sheep-pox, by N. Kii and H. Kasai (pp. 2654–2659); Experimental Studies on the Prophylactic Inoculation against Rinderpest, by C. Kakizaki (pp. 2660–2662); Rabies and Its Control in Japan, by S. Kondo (pp. 2662–2666); and An Experimental Study on the Virus of Fowl-pest.—I, On the Susceptibility of the Pigeon, by N. Nakamura and Y. Kawamura (pp. 2667–2678).

A manual of helminthology: Medical and veterinary, H. A. Baylis (*London: Baillière, Tindall & Cox, 1929, pp. XI+303, figs. 200*).—Part 1 of this work (pp. 1–118) deals with the flukes or trematodes and the tapeworms or cestodes, and part 2 (pp. 119–276) with the threadworms or nematodes and the Acanthocephala or thorny-headed worms. An index to the parasites of man and principal domestic animals, arranged under their hosts (pp. 277–284), and a general index (pp. 285–303) are included.

The development of Fasciola hepatica L. in the final host, I. C. Ross and A. C. McCay (*Aust. Vet. Jour., 5 (1929), No. 1, pp. 17–23, figs. 3*).—The authors have postulated the theory that in heavy infestations with *F. hepatica* the maximum amount of damage does not take place at the time of entry of flukes into the liver, but some weeks later, when they have undergone considerable development.

B. melitensis and B. abortus, their pathogenicity for man and the monkey [trans. title], E. Burnet and E. Conseil (*Arch. Inst. Pasteur Tunis, 18 (1929), No. 1, pp. 21–42, figs. 5*).—This account is based upon the work noted from another source (E. S. R., 60, p. 870).

Two cases of undulant fever (Bang) in Poland [trans. title], S. Legezynski (*Compt. Rend. Soc. Biol.* [*Paris*], *99 (1928), No. 26, pp. 919, 920*).—The author here reports upon two cases of undulant fever (Bang), said to be the first recorded from Poland.

Rocky Mountain spotted fever, R. R. Spencer (*Jour. Infect. Diseases, 44 (1929), No. 4, pp. 257–276, fig. 1*).—This is a summary of the present status of the knowledge of the disease and its transmitting agents, particularly the spotted fever tick (*Dermacentor andersoni*), presented in connection with a list of 130 references to the literature.

Fatal septicemia in man due to Bacillus (Salmonella) suipestifer, J. T. Bauer and M. McClintock (*Jour. Infect. Diseases, 44 (1929), No. 4, pp. 292–297*).—The authors report upon a fatal human infection suggesting typhoid fever and due to an organism with the cultural and serologic characteristics of *B. suipestifer*, the source of which remains undetermined.

Observations on calcium deficiency as a cause of certain diseases of animals and man, C. E. Corlette (*Med. Jour. Aust., 1 (1928), No. 7, pp. 198–215; also in Vet. Jour., 84 (1928), Nos. 635, pp. 231–244; 636, pp. 295–304; 639, pp. 452–456; 640, pp. 507–514; 641, pp. 570–574*).—An extended discussion of the subject in connection with a list of 58 references to the literature. It is concluded that "calcium and/or phosphorus deficiency can cause nervous disorder

closely resembling that produced by deficiency of vitamin B. It is, or may be, implicated in many morbid conditions of man and animals in which nervous symptoms often occur. Amongst these are polyphagia, earth-eating (and 'sand disease'), bone chewing, coprophagia, 'ergotism,' 'lathyrism,' scrapie, or trotting disease of sheep, epizootic stringhalt, laminitis, rickets, osteomalacia, spasticity, paraplegia, tetany, milk fever and lactational dyspepsia of cattle and other animals, and the stijfziekte and lamziekte of South African cattle, and conditions answering to the same elsewhere. To these may be added some cases of supposed forage poisoning."

The poisoning of livestock by Drymaria pachyphylla, J. L. LANTOW (*New Mexico Sta. Bul. 173 (1929), pp. 13, fig. 1*).—Reports received by the station of losses of cattle in the southern portion of the State resulted in experimental work which has shown that all the above-ground parts of *D. pachyphylla*, one of the suspected plants, are poisonous at all stages of maturity. The plant has proved to be one of the most deadly of the poisonous plants, the losses of cattle in New Mexico within a few months' time often running into thousands of dollars. Considerable losses of livestock have been caused by dry plants of this species as well as by those in the succulent, growing condition.

It is pointed out that by better range practices, which include conservative stocking, grazing the forage at the proper times of the year and with the right sorts of livestock, correct salting and watering practices, etc., many poisonous plant areas will decrease in size, as well as in density of stand of the noxious species, the harmful vegetation being crowded out by the better grasses and shrubs. The plants may be killed by chemical sprays. It is pointed out that while grubbing is one of the most efficacious methods of eradication, it is comparatively seldom that a species can be completely eliminated by a single grubbing.

A bibliography on poisonous plants, compiled by the U. S. Department of Agriculture, is appended.

Infectious necrotic hepatitis (black disease) caused by B. oedematiens in a cow, A. W. TURNER (*Aust. Vet. Jour., 5 (1929), No. 1, pp. 11–17, figs. 3*).—This is a further account (E. S. R., 60, p. 179) of studies conducted, which indicate that *Bacillus oedematiens* is a source of considerable loss from this disease of sheep in Australia.

***Eimeria ellipsoidalis* nov. spec., a new coccidium of cattle**, E. R. BECKER and W. W. FRYE (*Jour. Parasitol., 15 (1929), No. 3, pp. 175–177, pl. 1*).—The authors describe a new coccidium obtained from a calf in Iowa, to which the name *E. ellipsoidalis* is given. Whether clinical symptoms are ever produced by this parasite or the closely related *E. smithi* Yak. and Gal. remains to be determined.

Periarticular phlegmons or dysenteria neonatorum of calves [trans. title], O. MAGALHAES (*Mem. Inst. Oswaldo Cruz, 21 (1928), No. 2, pp. 373–388, pls. 6; Eng. trans., pp. 381–388*).—An account of a disease of short duration confined to calves, a panzootic of which occurred in Minas Geraes in 1919. The author reproduced the disease experimentally for the first time in the buck goat. A preventive polyvalent vaccine was prepared from a culture of the causative organism and used in about 180,000 cases with good results.

Acidosis of pregnant ewes: So-called pregnancy disease of sheep, W. W. DIMOCK, D. J. HEALY, and F. E. HULL (*Kentucky Sta. Circ. 39 (1928), pp. 8*).—This is a practical summary of information in which it is pointed out that acidosis of pregnant ewes is, according to the result of the authors' investigations, a nutritional disease. In ewes showing typical symptoms of acidosis of pregnancy, the calcium content of the blood serum is low. The urine contains

albumin, acetone, and an increased amount of ammonia. The mortality from this disease varies from 5 to 20 per cent in affected flocks. Following the development of symptoms, treatment has proved of no value. Prevention depends upon maintaining the proper supply of calcium, preferably by the use of feeds relatively high in this element.

The pyobacillosis of sheep [trans. title], J. DESCAZEAUX (*Rev. Gén. Méd. Vét., 37 (1928), No. 436, pp. 193–211*).—An extended account of studies of a disease of sheep occurring in Chile, the symptomology of which is quite variable, depending upon the localization of the causative organism. This pyobacillosis occurring in Chile resembles very much the disease which was described by Carré in France in 1912 under the name "mal de Lure" (E. S. R., 27, p. 887). The causative organism also possesses characteristics very similar to those of *Bacillus pyogenes ovis* of Carré. In young lambs the disease resembles the pseudotuberculosis described by Bridré. The causative agent resembles the Bridré-Sivori bacillus that Sivori and Marchisotti (E. S. R., 40, p. 683) described in Argentina from pyemia of swine, and that described by Pacella and Cortelezzi in caseous abscesses of bovines.

The subject is taken up under the headings of symptoms, lesions, diagnosis, etiology and pathology, treatment, and prophylaxis. A comparative table is given of the pyobacilli isolated from swine, cattle, and sheep.

Intracellular parasites of sheep in Northern Caucasus [trans. title], W. L. YAKIMOFF (*Arch. Protistenk., 65 (1929), No. 1–2, pp. 151–164, pl. 1*).—The author deals with the Piroplasmidae and Anaplasmidae, and reports personal observations of Piroplasma, Babesiella, Gonderia, and Theileria. A 3-page list of references to the literature is included.

On the infective larva of Ostertagia circumcincta (Stadelmann, 1894), a stomach parasite of sheep, D. O. MORGAN (*Jour. Helminthol., 6 (1928), No. 4, pp. 183–192, figs. 5*).—An account is given of both the biology and morphology of the third-stage larva of *O. circumcincta*, a common parasite of the abomasum of sheep and other animals and with a wide distribution. It is said that in association with *Haemonchus contortus* it undoubtedly plays an important part in the incidence of parasitic gastritis in these hosts. Longevity experiments with the larvae, while not complete, show that they are capable of living in water for at least three months.

Trichostrongylosis in sheep [trans. title], E. A. R. F. BAUDET (*Tijdschr. Diergeneesk., 56 (1929), No. 7, pp. 325–333, figs. 7; Ger., Eng., Fr. abs., p. 333*).—Descriptions are given of three nematodes, namely, *Trichostrongylus vitrinus* Looss, *T. extenuatus* (Rail.) Rans., and *Nematodirus filicollis* Rudolph, all of which are said to be pathogenic to sheep. In the Netherlands many digestive troubles in ruminants are attributed to these small trichostrongylids. The sulfate of copper treatment effective against the stomach worm (*Haemonchus contortus*) is said to be ineffective against trichostrongylids.

Breeding for resistance to cholera in swine (*Iowa Sta. Rpt. 1928, pp. 33, 34*).—In continuing this work in 1927 (E. S. R., 56, p. 878), 10 pigs from naturally immune stock were tested for resistance to cholera. Three of these were given pen exposure and 7 were given an injection of hog cholera virus, the amount ranging from 0.1 to 5 cc. All 10 of the pigs proved nonresistant, the earliest mortality occurring on the twelfth day following exposure, and the last pig died on the twenty-third day. It is concluded from the results thus far obtained that resistance, if hereditary, is a complex recessive trait.

The function of the fowl's ureters, O. S. GIBBS (*Amer. Jour. Physiol., 87 (1929), No. 3, pp. 594–601, figs. 6*).—The author's studies suggest a new function for the ureters in the fowl, namely, that of holding up of renal secretion.

Fowl typhoid and bacillary white diarrhoea, G. Martinaglia (*Jour. So. African Vet. Med. Assoc., 1 (1928), No. 2, pp. 77–81, pl. 1*).—This is a general account of two diseases of poultry assuming economic importance in South Africa, in which the findings of workers in other parts of the world are briefly considered.

Breeding for resistance to fowl typhoid in poultry (*Iowa Sta. Rpt. 1928, pp. 60, 61*).—It was observed in 1927 that there was a marked reduction in the mortality of chicks descended from parents that had survived an acute infection of fowl typhoid. The total mortality in a population of 405 chicks in a group with typhoid-surviving parents was 40.9 per cent following infection, while in a second group of 410 chicks, the parents of which had not had typhoid, the mortality was 88.6 per cent. In a third lot of 202 chicks, in which the sire alone was a typhoid survivor, the mortality was 62.4 per cent.

In 1927 the plan of the experiment was changed so that all chicks were inoculated when 7 days old instead of as adult birds as in previous years, and the results were found to be much more consistent. It was determined that there is some relation between the number of bacteria injected and the resulting mortality.

An investigation of the parasitic specificity of Coccidia [trans. title], C. Cobcuff (*Ann. Parasitol. Humaine et Compar., 6 (1928), No. 4, pp. 404–418*).—The author reports upon experiments in which numerous completely segmented oocysts of *Eimeria stiedae*, the cause of hepatic coccidiosis of the rabbit, were fed to chicks of from 1 to 32 days of age without inducing any infection. The cysts were all eliminated, unaltered, the first day. Thus the author was unable to substantiate the findings of Uhlhorn (E. S. R., 55, p. 777), who reports having readily induced such infection. He concludes that there is no indication of any relationship between hepatic coccidiosis of the rabbit and intestinal coccidiosis of the chicken.

A list is given of 25 references to the literature.

The treatment of intestinal coccidiosis of young fowls [trans. title], L. Riedmüller and E. Lutz (*Schweiz. Arch. Tierheilk., 70 (1928), No. 1, pp. 22–32, figs. 2; abs. in Ann. Méd. Vét., 74 (1929), No. 2, p. 88*).—The authors have found in the treatment of coccidiosis of young fowls that creolin is ineffectve, but that sour milk has a favorable effect.

The large round worm of the fowl (Ascaridia galli Schrank), F. V. Theobald (*Jour. Southeast. Agr. Col., Wye, Kent, No. 25 (1928), pp. 83–85, fig. 1*).—A brief summary of information on this nematode.

AGRICULTURAL ENGINEERING

[Agricultural engineering investigations at the California Station] (*California Sta. Rpt. 1928, pp. 48–52*).—In studies of the heating of milk cans over steam jets A. W. Farrall found that wet or saturated steam is best for the first steaming, but that this should be followed by a second heating with superheated steam for satisfactory results in a can washer. The superheated steam left less moisture to be removed than did wet or saturated steam.

In a study of solar water heaters Farrall reported that data taken in northern California on a bright, sunshiny April day between the hours of 8 a. m. and 5 p. m. showed an average absorption of 2.23 B. t. u. per minute per square foot of exposed area by a single glass-covered stationary absorber. The studies showed that the efficiency of this type of absorber could be increased approximately 15 per cent by embedding the coil in cement plaster having a black painted surface exposed to the sunlight.

Studies by Farrall with a large size, steam-type, electrically heated dairy sterilizer showed that good bacterial reduction was possible and that the heating was sufficiently rapid for practical purposes. The sterilizer, which had a box 4 by 4 by 5 ft. inside dimensions equipped with three 5-kw. electric heaters brought 261 lbs. of dairy equipment to a temperature of 170° F. in 26⅔ minutes. The energy consumption was at a rate of 17.4 kilowatt-hours per hour. Prompt withdrawal of equipment from the sterilizer was found to be desirable in order to allow rapid drying of utensils to avoid rusting. The development of a protective device to prevent the burning out of heating elements in case of lack of water is desirable.

In a study of substitutes for wooden breakpins on tractor drawbars A. H. Hoffman found soft steel rivets to be a satisfactory substitute.

J. D. Long reported that the studies of farm fencing showed that concrete posts with wood nailing strips incorporated are failing, and this type of construction appears impractical. Unsurfaced steel posts after four years are rusted, but the strength is not appreciably impaired. Aluminum, oil, and lead-painted steel posts are showing rust. Galvanized steel posts show no signs of rust except at the driving end. There appears to be little choice as to shape of steel post except that I, L, and T shapes cut the ground more readily than the round.

E. G. McKibben found in analytical and laboratory studies of simple shock-absorbing drawbar springs that a properly selected spring can give satisfactory overload protection at low and medium tractor speeds if the implement is designed to withstand safely a drawbar pull of 1.5 to 2 times the maximum tractive ability of the tractor. At higher speeds a spring is not practical to replace the breakpin, but springs may be used to reduce stresses resulting from increased loads or speeds, and thus reduce the frequency of breakpin replacements. The effectiveness of a spring, strong enough not to be completely compressed, in preventing increase in the drawbar pull varies as the value of the speed of the tractor times the square root of the product of its weight, times the load-deformation ratio of the spring.

McKibben also found that spring-held overload release hitches should have uniformity of pull for release at a given adjustment, and that this pull should be proportional to the adjustment. Such hitches must also be designed for minimum wear of tripping mechanism and with adjustments to overcome wear. These studies indicate there are no fundamental mechanical reasons why such hitches can not be devised to give more satisfactory service than breakpins.

B. D. Moses and E. L. Overholser found, in studies of the temperatures of fruit packed in standard boxes and crates and placed in different locations in cold storage rooms and refrigerator cars, that the factors affecting the rate of cooling are initial fruit temperature, temperature of the storage space, method of wrapping and packing, kind and condition of fruit, and freedom of air circulation.

E. J. Stirniman found in rice drying studies that bound rice placed in shocks lost most of its moisture during the first 80 hours after cutting, while bundles laid flat on the stubble dried out a similar amount in 50 to 55 hours. Very little moisture loss occurred after these periods.

[Agricultural engineering investigations at the Indiana Station] (*Indiana Sta. Rpt. 1928, pp. 25–28, figs. 3*).—Feed grinders, designed especially for motor drive, were found to be practical for grinding small grain and ear corn in limited quantities, saving time and giving a cost, with electricity at 7 cts. per kilowatt-hour, much less than the custom charge for grinding. Records on an electric refrigerator showed 2,476 kw. hours used to cool and store 242 qt. of milk and cream daily at a temperature of approximately 34° F. Tests on

silage cutters revealed the probability of successful electrical operation with speeds as low as 400 r. p. m.

In an electrically operated seed corn germinator heated by two 500-watt space heaters, three kw. hours were used to test each 100 ears of corn. Tests with electric brooders equipped with 500-watt, 1,000-watt, and 1,500-watt heating elements, showed that the 500-watt brooder had very little or no reserve heating capacity for conditions which prevailed in February and March. Observations on electric water heaters for poultry indicated that heaters with a range of heating capacity are more economical than those with only one heat.

In combining tests, harvesting losses with the combine were found to average less than 10 per cent, as compared to from 15 to 45 per cent with other methods.

On the experimental terraced field at Paoli no visible erosion took place in the flow lines of the Mangum terraces having a grade of 0.6 per cent or less. Where the clover and timothy sod was light there was slight erosion in the flow line having a 0.7 per cent gradient, but none where the sod was heavy.

A study of the effect of artificial heat and insulation upon temperature, relative humidity, and air movements in poultry houses revealed that when the temperature was maintained above 40° F. the relative humidity was 10 to 20 per cent lower than when no artificial heat or insulation was used. The litter remained drier and the birds appeared to be more comfortable, but the condition was not reflected in an increased egg production.

In the grain and hay drying tests soft, moist corn which was spoiling in the crib was dried out and made fit for permanent storage at a cost for fuel of 3 cts. per bushel. Alfalfa hay, which had been lying in the windrow for two weeks, was reclaimed by artificial drying at a cost of $1.35 per ton for fuel.

[Agricultural engineering investigations at the Iowa Station] (*Iowa Sta. Rpt. 1928, pp. 10–13*).—Tests of a newly developed tillage machine, in which the moldboard of a standard plow is replaced by a revolving pulverizer head having blades which engage the furrow slice, beat and mix the soil, showed that the reduction of drawbar horsepower over that required for a plow is sufficient to furnish a large part of the power needed to drive the pulverizer.

Experiments with a masonry arch barn showed that under favorable conditions the cost would be from 25 to 50 per cent more than that of wooden construction. Experiments on waterproofing the roof showed that treatment with raw linseed oil gives promise of being entirely satisfactory and very economical.

In ice house experiments it was found that the ice house with the ice above the refrigeration had much to commend it on account of the small amount of labor required. With this type of ice house, which is admittedly only suited to special locations, the entire ice storage is built over a permanent refrigerator, often connected directly to the basement of the house. The ice over the refrigerator keeps it cool, while the labor of icing is eliminated and unusual efficiency in the consumption of ice is obtained. The labor of handling the stored materials is, however, increased.

In tests of dairy barn floors the concrete and rubber block floors showed much the least wear. The wood block did not show much wear, but was not particularly sanitary.

The study of the air requirements of poultry showed that air purity is in itself of secondary importance. Temperature extremes and particularly rapid temperature fluctuations have an almost immediate effect in reduced production. Excessive relative humidity, while not desirable, does not produce detrimental results when the temperature is moderate and fairly constant.

Some data are also briefly presented on harvesting corn stover for industrial purposes and on corn production.

[Irrigation investigations at the California Station] (*California Sta. Rpt. 1928, pp. 84–88*).—S. H. Beckett reported that the field studies of the consumptive use of water by citrus, avocados, and vines have shown that under average irrigation practice in northern San Diego County 60 to 65 per cent of the water applied to an irrigated area serves a useful purpose, the remaining 35 to 40 per cent being lost by surface run-off, evaporation during irrigation and from the soil mulch, and deep penetration; that in half of the years over a 50-year period, from one to two irrigations will be needed during the period December to March; and that with winter requirements met by either rainfall or irrigation, mature groves in the interior valleys of San Diego County need for maximum production 18 acre-in. of water per acre to be applied during the summer period April to November.

F. J. Veihmeyer and A. H. Hendrickson, in studies of the effect of late irrigation on the canning quality of peaches, found that differences in soil moisture above the wilting coefficient, even if caused by irrigation within a few days of picking, do not produce differences in the canning quality of the product.

In studies of the residual moisture of 29 soils at permanent wilting of plants by Veihmeyer and Hendrickson, a remarkable constancy has been shown in the residual moisture of any given soil at the beginning of wilting, even under widely varying evaporating conditions. However, the relationship between moisture equivalent and wilting coefficient can not always be expressed by the factor 1.84. While the residual moisture of some soils at wilting closely agrees with the 1.84 ratio, its general use is open to serious criticism. The experimental plants were able to reduce the moisture of different soils to different points prior to permanent wilting, ratios between the moisture equivalent and the wilting coefficient ranging from 1.73 to 3.82.

The investigation by M. R. Huberty of the consumptive use of water by deciduous fruits in the Sacramento Valley showed that during the period April 1 to November 1, consumptive use of water by mature deciduous orchards, planted 24 by 24 ft., is about 24 acre-in. of water per acre.

Rice and cotton irrigation investigations by C. F. Dunshee showed that satisfactory control of early types of water grass in rice fields has been accomplished through seven consecutive years, following without interruption four consecutive years of commercial rice cropping. Growing rice in 96 small plats at the Biggs Rice Field Station, Dunshee and J. W. Jones have shown that submergence to a depth of 10 in. does not kill the white water grass. Tests during three seasons in 18 tanks 27.5 in. in diameter and 4 ft. deep indicate that of the water applied to rice fields approximately 15 per cent is lost by evaporation from the water surface, 25 per cent by seepage, and 60 per cent by transpiration.

Measurement of pipe flow by the coordinate method, F. W. Greve (*Purdue Univ., Engin. Expt. Sta. Bul. 32 (1928), pp. 31, figs. 7*).—Investigations are reported which were made to determine (1) the empirical relation between the rate of discharge from a horizontal pipe and the coordinates of the upper surface of the issuing stream, or jet, measured from the top, inside of the pipe at the point of discharge; (2) the relation between the actual mean velocity within the pipe to that indicated by the law of a freely falling body in vacuo as applied to the upper surface of the jet; and (3) the possibilities and limitations of the method, especially as to the effect of the personal element in taking measurements.

The diameter of the test pipes varied from 2 to 6 in. The minimum length of horizontal pipe under test was 40 ft., the flow thereto being supplied by centrifugal pumps and controlled by valves. Movable chutes served to direct

the discharge into calibrated weighing tanks during a test and to shunt it back into the reservoir between tests.

The results showed that the coordinate method of determining pipe flow is simple, inexpensive, and practical for field tests where a maximum error of 10 per cent is permissible.

The discharge in cubic feet per second, q, from partially filled pipes with limiting nominal diameters of 2 and 6 in. and with a ratio of depth to diameter at the outlet between 0.2 and 0.6, can be computed from the equation,

$$q=9.43[d]^{2.56}\ [K]^{1.84} \qquad [10]$$

where d is the true diameter in feet, and

$$q=0.0181[d]^{2.51}\ [K]^{1.84} \qquad [11]$$

where d is the nominal diameter in inches. K is the ratio of depth to diameter.

The ordinate, y, increases directly with the abscissa, x, with constant rate of discharge, and therefore the effect of an error in measuring the former distance decreases as the latter is extended. However, at values of x greater than 2 ft., the stream disintegrates and the data become inaccurate.

The coefficient, C, in the equation for calculating the mean actual velocity of pipe flow in feet per second, $v=C\sqrt{2gy}$, will not vary more than 5 per cent from unity when x equals 2 ft.

Public Roads, [April, 1929] (*U. S. Dept. Agr., Public Roads, 10 (1929), No. 2, pp. 21–36+[2], figs. 28*).—This number of this periodical contains the status of Federal-aid road construction as of March 31, 1929, together with the following articles: Parkway Features of Interest to the Highway Engineer, by E. W. James (pp. 21–27, 32); A Machine for Molding Laboratory Specimens of Bituminous Paving Mixtures, by J. T. Pauls (pp. 28–32); and Some Aspects of Flow of Water Around Bends and Bridge Piers, by D. L. Yarnell (pp. 33, 34).

Knock ratings of pure hydrocarbons, A. W. Nash and D. A. Howes (*Nature [London], 123 (1929), No. 3095, pp. 276, 277*).—Experiments conducted at the University of Birmingham, England, on the antiknock properties in an internal-combustion engine of pure samples of eight hydrocarbons mixed with unsaturated materials are reported. These were used in 20 per cent concentrations.

The results showed that cyclohexene has antiknock properties equivalent to benzene, while the others were far more effective than benzene, especially diamylene and diisobutylene, which at a concentration of 20 per cent were found to be equivalent to 37.5 per cent and 40 per cent benzol, respectively. Tested on the same scale, 20 per cent of toluene was found to be equivalent to 22.5 per cent of benzol. Thus aromatic hydrocarbons have lower knock ratings than the unsaturated materials.

Of the olefines tested, those which are the more stable toward bromine, sulfuric acid, potassium permanganate, and potassium bichromate are the more effective in suppressing knocking.

Knock ratings of pure hydrocarbons, S. F. Birch and R. Stansfield (*Nature [London], 123 (1929), No. 3100, pp. 490, 491*).—This is a critical comment on the report of Nash and Howes (noted above) in which additional results are reported.

Electric incubation and brooding, H. L. Garver and J. S. Carver (*Washington Col. Sta. Bul. 231 (1929), pp. 38, figs. 22*).—The results of studies conducted by the station in cooperation with the Washington Committee on the Relation of Electricity to Agriculture are reported.

They indicate the importance of a reliable and constant source of electric current for the successful operation of electric incubators and brooders. When

the supply of current is not subject to frequent or long interruption the electric incubator is deemed a success. The heat insulation should be sufficient to carry the eggs through a 2 or 3 hour interruption in the power supply without allowing the temperature to drop to a dangerous point. The brooder room or house should be of double-walled construction with a ceiling not more than 7 ft. from the floor. Electric brooders equipped with curtains are much more economical to operate under the climatic conditions encountered in Washington.

The ventilation of the electric brooder is very important and can best be solved by placing the brooder on a ½-in. mesh hardware cloth frame raised 2 to 4 in. from the floor. This permits of constant circulation of air and keeps the floor of the brooder clean, dry, and sanitary. Chicks brooded under electric brooders, on wire floors for an 8-week period, are not affected with coccidiosis. The electric brooders maintain an absolutely even and regulated temperature because of control by the automatic thermostat. The low mortality records demonstrate the excellent results of uniformity in temperatures through the first few weeks of brooding.

RURAL ECONOMICS AND SOCIOLOGY

[**Investigations in agricultural economics at the Indiana Station, 1927–28**] (*Indiana Sta. Rpt. 1928, pp. 9–13, 15, 16, 17, 18, 44–46, fig. 1*).—Results not previously noted are reported as follows:

[*Producers' method of disposing of cream*].—A survey in counties in the southern part of the State showed that before a grading system was installed 15 per cent of the farmers delivered cream at intervals of less than 4 days. After the installation 51.4 per cent delivered every 4 days or less. From May to January farmers in 8 counties received $10,072.90 more than they would have received had the grading work not been in effect.

[*Marketing eggs on a quality basis*].—Data gathered in the territory around Odon showed that the difference in the price of grade 1 and grade 2 eggs gradually increased from 5 cts. in April to 18 to 20 cts. in December. Hucksters, grocers, and truck drivers in April paid from 1 to 2 cts. per dozen more on a "mine run" basis than was paid for grade 2 eggs. During the winter the difference reached from 4 to 6 cts.

[*Dairy farming in northwestern Indiana*].—A study of the economic factors showed that (1) improved methods and decreasing shipping costs are widening the area of fluid milk production, making dairying an important source of income and causing readjustments in cropping systems and livestock production; (2) a reduction in the cost of shipping by tank makes it possible for almost a third of northern Indiana to ship into Chicago cheaper than it was possible formerly in cans by rail from northwestern Lake County; (3) with present production methods an annual increase of 542 herds of 15 cows each is necessary to supply milk and sweet cream for the annual increase in population in the accessible consuming areas; and (4) increasing competition means decreasing opportunity for a high degree of specialization in dairy farming.

[*Two-litter system of hog production*].—Five years' records on 12 Tippecanoe County farms showed that the price and profit per 100 lbs. of pork were $10.19 and $3.29, respectively, for hogs produced for the early market, and $9.02 and $2.39, respectively, for those produced for the late market. The investment per farm in hog houses and equipment was $346.54 on farms having central houses, being 64 per cent higher than on farms having individual houses. The average number of pigs weaned per litter was 5.44 on farms with central houses and 5.51 on farms with individual houses.

[Investigations in agricultural economics at the Iowa Station, 1927–28] (*Iowa Sta. Rpt. 1928, pp. 6–10*).—Results of investigations not previously noted are reported as follows:

Farm tenancy in Iowa.—Schedules from some 150 farms in Palo Alto County showed the following facts: (1) The grain-share lease in common use is detrimental to livestock farming and soil fertility, as the landlords insist on a maximum acreage of the higher yielding grain crops and a minimum acreage of forage crops; and (2) comparatively few grain-share landlords are in a position to become stock-share landlords, due to heavy mortgages making immediate and pressing need for a maximum income, inability to give personal attention to the farm, or the lack of experience and capital on the part of tenants.

Gross income to Iowa farmers.—Data for 1927 were added to the study previously noted (E. S. R., 57, p. 588). The income from the 10 sources of income decreased 3 per cent from 1926 to 1927. Receipts from cattle, sheep, wheat, barley, and butter showed increases. Those from hogs, corn, oats, eggs, and poultry showed decreases, the most significant being those from hogs due to the very marked decline in prices in the spring of 1927.

Cost of production studies.—The 3-year study in Iowa County closed June 30, 1928, showed (1) a tendency to devote too large an acreage to low yielding crops, (2) failure to secure the highest yields economically possible, (3) a very wide range in efficiency in cattle and hog production, and (4) wide differences in the effectiveness of the management of financial affairs by different farmers.

[*Egg marketing*].—A questionnaire survey of representative produce dealers showed that (1) buying on the basis of grades had increased, but that practices varied greatly; (2) the larger number of dealers have found strict grading impractical; and (3) in general those buying on the basis of grades paid the higher average prices.

Reports of the experts submitted to the Joint Palestine Survey Commission (*Boston: Daniels Ptg. Co., 1928, pp. 741, pls. 2, figs. 199*).—The reports presented include the following: The Labor Movement and Cooperation, by L. Wolman (pp. 491–535); A Sanitary Survey of Palestine, by M. J. Rosenau and C. F. Wilinsky (pp. 537–741); and Agricultural Colonization in Palestine, by E. Mead et al. (pp. 7–65), supplemented by the following reports; Summary of Economic Data Relating to Jewish Agricultural Colonies in Palestine, by F. Adams (pp. 67–142); Soil Reconnoissance of Palestine, by A. T. Strahorn (pp. 143–236); The Horticultural Possibilities of Palestine as Especially Related to Agricultural Colonization, by K. A. Ryerson (pp. 237–397); Irrigation and Water Supply, by C. Q. Henriques (pp. 399–417); and Report on Education and Research, by J. G. Lipman (pp. 419–430).

There are also included a Report on the Jewish Settlements in Palestine, by J. Campbell (pp. 431–478), and a Report on a Visit to Palestine, by E. J. Russell (pp. 481–490).

Use and taxation of land in Lincoln County, Wisconsin, B. H. Hibbard, W. A. Hartman, and W. N. Sparhawk (*Wisconsin Sta. Bul. 406 (1929), pp. 38, pls. 8, figs. 4*).—Facts that in 17 northern counties of Wisconsin tax certificates on nearly 25 per cent of the land were offered for sale at the 1927 tax sale and that over five-sixths of the area had not been redeemed by the owners within almost a year following the sale have presented a very serious situation. The study reported in this bulletin was made to present the leading facts with a view of showing the chief considerations that must be taken into account in working out a land program for the area.

In Lincoln County nearly 25 per cent of the land was offered for sale at the 1927 tax sale. Of the total area sold for taxes, 57 per cent had been sold for taxes two or more times, and nearly one-third three or more times. Since 1921 nearly one-third of the total area of the county had been tax delinquent one or more times. The amount of delinquent taxes increased over 600 per cent from 1919 to 1927. In four towns of the county from 1919 to 1927, the tax levies increased from 6 to 31 per cent, averaging 24 per cent, but tax collections decreased from 1 to 53 per cent, averaging 11 per cent. Of the land in the county, 43 per cent was not in use and 17.6 per cent was in abandoned farms, according to data collected in 1926.

The effect of the large amount of delinquent taxes on county, town, and school finances, and the effect of the school equalization law passed by the State legislature in 1927 are described. Forestry by private parties, the county, the State, or the Federal Government as a remedy for the present situation is discussed. Public ownership of much of the forest land is deemed desirable, inevitable, and also possible under the present laws.

This study was made in cooperation with the U. S. D. A. Forest Service.

The agricultural credit situation in Minnesota, B. M. Gile and J. D. Black (*Minnesota Sta. Tech. Bul. 55 (1928), pp. 98, figs. 20*).—The purpose of this bulletin is "to uncover as many as possible of the real facts as to this [agricultural credit] situation, discover their significance and their causes, and show their relation to the credit institutions that have been established and to their manner of functioning."

The material is presented under the headings of (1) mortgage encumbrance, including descriptions and discussions of the situation in 1925, the changes from 1890 to 1925 in farm owners' equities, land prices, size and number of farms, tenancy, distribution of mortgage indebtedness within the State, and mortgage interest rates, the relation of tenancy to the credit problem, progress of individual farmers, sources of long-term loans, and second mortgage loans; (2) short-term credit, including discussions of the purpose of, security for, and period of short-term loans, and the need for better bank loan practices; (3) intermediate credit, including a description of the volume of such credit and the agricultural credit corporations in Minnesota; and (4) the problem of the local bank, including discussions of the reasons why banks have failed and the recent changes in the banking laws, and making suggestions for further changes.

Various publications of the Federal departments, boards, and commissions, State experiment stations, the Minnesota Department of Banking, and the Minnesota Department of Rural Credits; books of numerous individual authors; and a considerable number of articles in economic and financial periodicals were used as sources of material. Data are also included from studies made by A. Boss of 106 Minnesota owner farms in 1924; of 157 Minnesota farm families in 1925 and of 215 Minnesota owners and 120 tenants in 1926, made by C. C. Zimmerman; and from a special survey made in the fall of 1924 of 240 farms in 6 representative areas of Minnesota.

Of the farms included in the special survey in 1924, 172 were operated by owners. Of these, 106 were mortgaged. Of the 106 mortgages, 36, averaging $4,680, were placed on the farms after 1920. Since 1920, 22 had been rewritten at an average increase of $1,740, 32 had been renewed for the same amount, and 16 were unchanged. Of the 36 new mortgages, 8, averaging $2,071, were to finance or cover indebtedness in connection with buildings or general farm expenses; 24, averaging $5,520, for land purchases; and 4, averaging $4,575, were to cover purchases plus buildings or other farm ex-

penses. Of the new mortgage debt not used for the purchase of land, 62 per cent was for new building operations, 8 per cent for new equipment, and 30 per cent for general farm expenses, chiefly taxes.

Of the 172 owner-operated farms, the increases in net worth from the date of purchase to 1924, after deducting gifts, for the different groups according to date of purchase were as follows: 1880–1890, $14,751; 1891–1900, $13,523; 1901–1910, $11,255; 1911–1915, $5,824; 1916–1918, $6,297; 1919–1920, —$89; and 1921–1924, $249. Of the 112 mortgaged farms, the average value of the real estate increased from $8,500 at date of purchase to $11,800 in 1924, and the mortgage debt from $4,700 to $4,800. Of the 104 farmers who had bought farms before 1916, only one had debts amounting to more than 61 per cent of his assets, while of the 68 who had purchased after 1916, 12 were indebted for more than 61 per cent of their assets and 6 for more than 81 per cent. Of the 172 owner-operators, 3.5 per cent are near bankruptcy, and probably 4 per cent more could not remain solvent if crops failed for one or two years or if price levels for products declined for a considerable time.

Short-term credit was being used by 61 per cent of the tenants and 44 per cent of the owner-operators, the average amount per debtor being $1,581 and $1,143, respectively. The owner-operators used 40, 27, and 21 per cent of the amount of collateral or personal loans for land purchases, buildings and improvements, and operating expenses, respectively. The tenants used 44 and 40 per cent, respectively, for equipment and machinery and livestock. Seventy per cent of the owners and 38 per cent of the tenants borrowed on unsecured notes. Mercantile credit was used by 13 per cent of the owners and 17 per cent of the tenants, the average amounts per individual being $189 and $169, respectively. Of the owners, 85 per cent paid 8 per cent on short-term loans, and the others from 6 to 7.5 per cent.

The special survey in 1924 and the other studies made in 1924, 1925, and 1926 all indicated that the farm mortgage indebtedness in Minnesota probably was greater than shown by the 1925 United States census data.

The manufacture and distribution of tomatoes, sweet corn, and peas in Maryland, W. J. Hart (*Maryland Sta. Bul. 301 (1928), pp. 63–145, figs. 25*).—This bulletin presents the results of a study of the manufacture and distribution of tomatoes, sweet corn, and peas for the seasons of 1925, 1926, and 1927. Data were obtained directly from the books of the canners by periodical visits and covered about 100 plants each season, being approximately 25 per cent of the plants in operation. The study covered a total of 5,318,349 cases of canned products, and included 26.3 per cent of the total for the State for tomatoes, 25.1 per cent for corn, and 14.5 per cent for peas.

The average costs per dozen cans for the 3-year period were for tomatoes, No. 1 cans 50.75 cts., No. 2 cans 82.06 cts., No. 3 cans $1.2732, and No. 10 cans $3.5896; for corn, No. 2 (crushed) 88.28 cts., No. 2 fancy shoe peg $1.1187; and for peas, No. 2 cans 93.02 cts. Tables are given showing for each year for each product by size of can the itemized costs per dozen cans. The average returns on investment for the three products for the three years were for tomatoes —2.15, 2.12, and 6.91 per cent, respectively; corn 0.82, 2.30, and 9.48 per cent, respectively; and peas 14.08, 0.44, and 6.9 per cent, respectively.

Factories canning different numbers of crops had average returns for the three years as follows: One crop —3.17, 0.75, and 0.97 per cent, respectively; two crops 4.48, 6.43, and 12.42 per cent; and more than two crops 10.65, 1.88, and 6.24 per cent. A comparison of data for tomatoes (No. 2 cans) for the 3-year period in 36 factories with highest profits and 36 factories with lowest profits showed the following: Average profits per factory, $2,731 and —$2,835,

respectively; percentage of factories canning two or more products, 46 and 25; cases obtained per ton of raw stock, 33.4 and 31.3; investment per 1,000 cases packed, $604 and $890; average number of cases packed, 23,982 and 19,428; percentage of goods sold as futures, 31.2 and 15.6; cost per dozen cans, 81.29 and 87.62 cts.; and average selling price per dozen cans, 87.23 and 80.08 cts.

A distribution of the average consumer's price ($1.275 per dozen cans) during the 1926 season in the Baltimore market for tomatoes (No. 2 cans) showed the following: Cost of raw stock 18.68 per cent, manufacturing costs 44.94, canner's selling costs 3.91, canner's profit 0.94, transportation costs 4.89, wholesaler's gross margin (exclusive of transportation costs) 6.64, and retailer's gross margin 20 per cent.

Other sections of the bulletin describe and discuss the position and scope of the canning industry in the United States and Maryland; the distribution of Maryland canned foods, including agencies, storage, financing, competition, exports and imports, factors affecting prices, etc.; and the consumption of canned foods.

A study covering 166 retail stores and 10 wholesale establishments in 6 large Maryland markets showed that 78.8, 76.7, and 25.6 per cent, respectively, of the tomatoes, corn, and peas handled were packed in Maryland, the 10 wholesalers and 144 of the retail stores reporting 85.4, 72.8, and 57.6 per cent, respectively, of the sales graded as standards. Of the 159 retailers, 42.8 per cent reported quality as the chief factor in purchases, 22.6 per cent price, 22.1 brand, 11.3 description, and 1.2 per cent appearance.

The most pressing needs of the Maryland canning industry were found to be the production of uniformly good quality products, sound financing, general adoption and use of uniform standards, reduction of brands and simplification of labels, more adequate cost records, improved methods of sale and distribution, collection and dissemination of market information, closer associational activity, and the utilization of by-products.

Report on the marketing of wheat, barley, and oats in England and Wales (*[Gt. Brit.] Min. Agr. and Fisheries, Econ. Ser. 18 (1928), pp. 206, pls. 21, figs. 8*).—This report discusses the world position, home crop, imports, total supplies, quality factors, demand, and prices for each crop; the threshing, dressing, sampling, assembling, grading, and standardization in England and Wales and other countries; the storage, transportation, and distribution of home-grown and imported grain; the processing and distribution of cereal products; and the distribution and control of seed in England and Wales. The special problems of each grain are discussed and recommendations made in the summary.

Pooling as practiced by cooperative marketing associations, C. L. Christensen (*U. S. Dept. Agr., Misc. Pub. 14 (1929), pp. 12*).—A brief discussion is given of the advantages of pooling and the methods of pooling marketing expenses and distributing sales returns.

Crops and Markets, [April, 1929] (*U. S. Dept. Agr., Crops and Markets, 6 (1929), No. 4, pp. 113–160, figs. 3*).—Included are tables, graphs, notes, reports, and summaries of the usual types. Special articles and tables deal with farmers' intentions to plant in 1929, based upon returns from 50,000 producers; the relation of farmers' planting intentions to the agricultural outlook for 1929; the changes in the number of persons living on farms during 1928; and the prices of purebred cattle, hogs, and sheep in 1927 and 1928.

Dairy statistics (*U. S. Dept. Agr., Statis. Bul. 25 (1929), pp. 256*).—This bulletin is "an extensive compilation of dairy statistics that will be of assistance to milk producers, milk distributors, butter and cheese makers, con-

densed, evaporated, and powdered milk manufacturers, county agents, agricultural students, and others interested in the dairy industry." The statistics are for the year ended December 31, 1926, with comparable data for earlier years. The statistics cover the United States and foreign countries.

Urbanization: Its effects on government and society, J. G. THOMPSON (*New York: E. P. Dutton & Co., 1927, pp. XIII+683*).—This is a treatise on the political and social consequences of urbanization and rural depopulation. Included are chapters on the rural and urban contributions to democracy in ancient and medieval times, in modern Europe, and in the United States; the effects of urbanization upon political knowledge, initiative, inventiveness, activity, leadership, purity, and preparedness for war, and upon public spirit, efficiency of government, economic efficiency, health, physique, and natural growth of the population; and the moral and religious consequences of urbanization.

Principles of rural sociology, G. A. LUNDQUIST and T. N. CARVER (*Boston and London: Ginn & Co., 1927, pp. VII+484, figs. 16*).—This book is intended "as an introductory study of rural problems in the United States," its aim being "to show how rural conditions, especially those in the United States, have come to be what they are."

The several chapters present tables, maps, and graphs showing the status of the rural population, comparisons with urban centers, and other facts and interpretations of and observations on the data presented on how rural people think and feel; rural social origins, maladaptation, education, health and sanitation, and leadership; the rural community, standard of living, village, and home; science, communication, government, and religion and rural life; the farmer in politics; farmers' nonpolitical organizations; land policies and rural welfare; the social aspects of farm tenancy and labor; the study of rural sociology; the land; and the people. Each chapter is followed by questions and references.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Training teachers of vocational agriculture in service, L. S. IVINS (*Fed. Bd. Vocat. Ed. Bul. 135 (1929), pp. IX+84*).—This bulletin is the seventh of the series previously noted (E. S. R., 58, p. 891; 60, p. 489), and reports the results of a study made to analyze the present methods of training teachers of vocational agriculture already in service and to discover principles to be followed in formulating State programs for training such teachers. The data are for the school year 1926–27 and were obtained by a questionnaire sent to the State supervisors of agricultural education. The answers to the questionnaires from each of the 46 States reporting represented the study of the State supervisor and his assistants, the teacher trainers, and the itinerant teacher trainers. The analysis of the data is reported under the following headings: How the work is organized, the field in which the improvement in service is undertaken, the itinerant teacher trainer, extension courses and correspondence work, conferences and summer schools, professional books and other literature, and a comparative study of the methods used in, and the benefits derived from, training in service.

Twenty-three recommendations are made as guiding principles in formulating State programs for training teachers already in service.

Forestry clubs for young people, M. F. HEISLEY (*U. S. Dept. Agr., Misc. Pub. 45 (1929), pp. II+21, figs. 2*).—This publication suggests forestry activities suitable for groups of young people and ways and means of carrying on such

activities. It is intended primarily for leaders of young people's forestry clubs. The organization of such clubs is discussed, and suggestions and outlines are given for studies and projects that may be carried on by such clubs. Lists are included of books and other publications suitable for use of forestry clubs, and of State forestry departments, State extension foresters, and Government and private organizations having information available for such clubs.

FOODS—HUMAN NUTRITION

The place of wheat in the diet, A. E. TAYLOR (*Wheat Studies, Food Research Inst.* [*Stanford Univ.*], *5* (*1929*), *No. 4, pp.* [*1*]+*147–174*).—The proper place of wheat in the diet is discussed from the economic and nutritional standpoints, with particular emphasis on the question of whole wheat v. white bread.

"Nutritionally considered, the place of wheat in the diet may be anywhere up to, let us say, two-thirds of the calories of the diet. The higher the proportion of wheat, or other cereal, in the diet, the greater the care necessary to secure the indispensable elements in order to avoid deficiency diseases. In the United States it is only where the statistically average diet is not had that the possibility of deficiency diseases arises.

"A broad survey of modern knowledge of nutrition, in a country with the agricultural characteristics of the United States, indicates that nutritional security in the diet is to be sought in the milk supply and that wheat (and other cereals) ought to serve us as fuel food. To consume our bread as whole wheat bread instead of white bread would make no essential contribution to the national health, and would not be in the interest of national economy. American agriculture is based on the diversified diet, and any step in the direction of vegetarianism is not in the economic interest of the present population as related to land area.

"Apart from nutritional considerations, the place of wheat in the diet depends on taste, custom, convenience, and price. Wheat is now one of the cheapest foods, and under conditions of prosperity there is little incentive further to cheapen the diet by increasing the consumption of wheat. Other things being equal, there is little reason to expect that consumption of wheat may be expanded by appeals on behalf of producers. With national income where it stands and a wide diversity of foodstuffs freely available, the present place of wheat in the diet has been arrived at through a series of adjustments and interactions which are not likely to be notably modified in the near future."

Baking tests with flour from Purkof wheat (*Indiana Sta. Rpt. 1928, pp. 48, 49*).—A composite of flours from four separate lots of Purkof wheat, a composite of flours from Poole, Trumbull, Fults, and Rudy varieties of wheat, and a combination of equal parts of these two composites were compared for baking qualities in biscuits, cakes, and pie crusts. Each of the three flours yielded products of satisfactory appearance, flavor, and texture. The Purkof flour appeared to require a little more liquid and shortening than the standard soft wheat varieties. Baking powder biscuits and white cake made with it were somewhat more creamy in color, and plain yellow cake somewhat lower in tenderness and lightness than corresponding products with the other flours, but the differences were very slight.

Effect of variation in the method of manufacture on the baking quality of dry skimmilk, E. GREWE and G. E. HOLM (*Cereal Chem., 5* (*1928*), *No. 6, pp. 461–469, figs. 6*).—In this extension of previous work of Greenbank et al. (E. S. R., 58, p. 689) six samples of skim milk were held for 30 minutes at temperatures of 50, 63, 73, 83, 93, and 100° C., respectively, dried by the spray sys-

em, and then used for viscosity determinations and for bread making with hree varieties of flour—a hard spring wheat flour, a hard winter wheat flour, and a soft winter wheat flour.

In the viscosity determinations with reconstituted milk there was a decrease in viscosity in the samples which had been heated to 50, 63, and 73°, a marked increase in the sample heated at 83°, and again a decrease in the samples heated to 93 and 100°.

The greatest improvement in baking as the result of the added skim milk powder was with the soft winter wheat flour and the least with the hard winter wheat. In all cases the range of fermentation time required for good bread was increased. The lowest scores for the bread were obtained for all three flours with milk previously heated to 50°. Slightly better results were obtained with the 63° sample and marked improvement with the samples heated to 73, 83, 93, and 100°.

Nutrition studies with meat (*Iowa Sta. Rpt. 1928, p. 62*).—In this progress report it is stated that albino rats on a diet of pressure-cooked beef 50, cornstarch 30, dried brewery yeast 5, salts 4, butterfat 8, cod-liver oil 2, and sodium chloride 1 part, grew and reproduced normally, but the second and third generations experienced difficulty in raising their young.

Fruit products (*California Sta. Rpt. 1928, pp. 113–116*).—It has been found by J. H. Irish and P. H. Richert that with grape juices containing many active yeast cells cooling in 50-gal. barrels at a temperature of 0° F. is not rapid enough to arrest fermentation, but is sufficiently rapid in 5-gal. cans.

Of various canned pear products, baked pears have proven very popular. Crushed pears were satisfactory as a base for water ices but not for ice cream.

Attempts by W. V. Cruess and Richert to preserve ripe olives and avocado pulp with sodium benzoate failed. On the theory that this might be due to the high pH values of these fruits, experiments were made with pure cultures of various yeasts and microorganisms to determine the effect of H-ion concentration on the concentration of sodium benzoate required to prevent growth. It was found that at pH 3 0.05 per cent of the benzoate was sufficient, while at pH 7 growth was not generally arrested by 1.5 per cent. It was found by Cruess that the pH value of olives at the time of canning is one of the chief factors affecting bleaching. Too low pH values induced by bacterial growth and too high induced by the presence of lye caused bleaching. The greatest stability was secured at pH 7.0 to 7.8. To correct acidity the addition of a small amount of sodium hydrogen carbonate to the brine was found satisfactory, while continued washing corrected too high alkalinity.

A study by M. A. Joslyn and J. W. Lesley of the losses of dill pickles by softening has shown that excessive acidity of the brine and immaturity of the cucumbers are predisposing factors.

Malt extract and oil emulsions, I–III (*Quart. Jour. Pharm., 1 (1928), No. 3, pp. 400–405*).—Three papers are presented.

I. *The composition of commercial malt extract and cod-liver oil emulsions*, J. M. Jones and T. McLachlan (pp. 400, 401).—Data are reported on the composition, including oil by weight, malt extract by weight (by difference), total solids in malt extract, diastatic activity of malt extract, and alcohol by weight, of 12 samples of cod-liver oil and malt extract emulsions. The percentage of oil varied from 2.5 to 19.81 by weight.

II. *The vitamin A content of commercial malt extract and cod-liver oil emulsions*, J. M. Jones (pp. 401, 402).—The oils separated from 6 samples of malt extract and oil emulsions were tested for vitamin A by the antimony trichloride color test, the blue tintometer units being converted into values corresponding approximately to the U. S. Pharmacopoeia biological units per gram. One of

the samples gave a negative test for vitamin A, and the others varied from 460 to 840 units per gram of oil. The oil extracted from a 23-year-old emulsion gave a color test of about 250 units.

III. *Note on testing malt extract and cod-liver oil emulsions for vitamin A*, J. M. Jones and N. Evers (pp. 402–405).—Evidence is presented indicating that calcium chloride is capable of accelerating the destruction of vitamin A by light. It is suggested that in following color tests for vitamin A the use of calcium chloride for drying the solutions to be tested should be avoided, and the oil should be kept in the dark as far as possible.

The content of zinc in the principal foods of vegetable origin [trans. title], G. Bertrand and B. Benzon (*Bul. Soc. Sci. Hyg. Aliment., 16 (1928), No. 10, pp. 457–463*).—Tabulated data are given on the zinc content in milligrams per kilogram of fresh and dried material in various food materials of vegetable origin. The smallest amounts, less than 1 mg. per kilogram, were found in the pulp of fruits such as peaches, prunes, apricots, and melons and in etiolated leaves such as endive. From 1 to 2 mg. per kilogram were present in root vegetables, orange pulp, lemon juice, leaves poor in chlorophyll, chestnuts, and grapes; from 2 to 3 mg. in the edible portion of pumpkins, bananas, cauliflower, potatoes, oyster plant, tomatoes, and Jerusalem artichokes; and from 3 to 4 mg. in rutabagas, asparagus, and dates. In chlorophyll-rich materials the amount of zinc was much higher, spinach containing 6.2 mg. and dandelion leaves 9.7 mg. per kilogram of the fresh material. Garlic and onions had an even higher content, from 10 to 13.8 mg. Cereals and legumes varied from 10 to 50 mg., the amount being higher in legumes than in cereals.

Observations on the hydrogen-ion concentration of the alimentary canal of the albino rat, G. R. McRobert (*Indian Jour. Med. Research, 16 (1928), No. 2, pp. 545–552, figs. 2*).—Hydrogen-ion concentration determinations by the quinhydrone electrode on segments of the intestines of rats killed by a sharp blow on the head are reported, with results indicating that the gastrointestinal contents of normal rats are acid except in the ileum, where, contrary to the results reported by Redman, Willimott, and Wokes (E. S. R., 57, p. 789), they are invariably alkaline. It is suggested that the preliminary handling entailed by the administration of a general anesthetic may have accounted for the difference in reaction reported by these authors.

After 18 or 20 hours starvation there was an increase in the area of alkalinity, but not until after approximately 27 hours did the whole alimentary canal below the pylorus become alkaline. The cecal contents again became acid soon after a meal. On a basal diet free from vitamins A, B, and D, the contents of the cecum, colon, and rectum were alkaline. The addition of cod-liver oil to the diet lowered the pH, but marmite had no effect. On diets deficient in vitamins A and D the addition of small amounts of milk, tomato, and lettuce, practically devoid of vitamin D, prevented the development of alkalinity.

The author suggests that the acidity of the cecum and colon is due to a specific secretion of acid or acid-forming material from the intestinal walls and not to residual acidity from the stomach or to bacterial action.

Later development of breast fed and artificially fed infants, C. Hoefer and M. C. Hardy (*Jour. Amer. Med. Assoc., 92 (1929), No. 8, pp. 615–619, fig. 1*).—Mental and physical tests were conducted on 383 children from 7 to 13 years of age of whom 38 had been artificially fed from birth and the others breast fed—78 for 3 months or less, 77 for from 4 to 9 months, and 190 for from 10 to 20 months.

The general conclusions drawn from the study were that the children who were breast fed for from 4 to 9 months were superior physically and mentally

to all of the other groups, that those fed exclusively on breast milk longer than 9 months developed physically at a fairly normal rate but ranked the lowest mentally of any of the groups, and that children fed artifically from birth were inferior to the other groups in all physical measurements except height, in various nutritional indexes, in susceptibility to children's diseases, and in learning to walk and talk.

A comparison of the development of children fed modified cow's milk with those receiving unsweetened evaporated milk led to the conclusion that the former was more satisfactory than the latter.

The physiological effects of protein, H. H. MITCHELL (*Jour. Nutrition, 1 (1929), No. 3, pp. 271–292*).—This critical review deals chiefly with the literature on the specific dynamic action of proteins, the so-called "secondary specific dynamic effect" or "deposit protein," conflicting views as to the optimum protein nutrition, protein anaphylaxis, and intestinal putrefaction.

"In conclusion, it appears that with proteins, as with other nutrients, successful nutrition and continued health and physiological efficiency are possible over a wide range of intake, though environmental and activity factors may contribute to the existence of certain optimal intakes for certain conditions of living, but that with proteins, as with no other nutrients, the body is on continual guard against the potentially deleterious action of its intermediate digestion products, bacterial end products, and intermediate metabolites."

A bibliography of 89 references is appended.

The protein question (*Jour. Amer. Med. Assoc., 92 (1929), No. 6, pp. 474, 475*).—Editorial comment on the above-noted review.

Production of renal injury in the white rat by the protein of the diet: Dependence of the injury on the duration of feeding, and on the amount and kind of protein, L. H. NEWBURGH and A. C. CURTIS (*Arch. Int. Med., 42 (1928), No. 6, pp. 801–821, figs. 12*).—In this investigation albino rats were fed supposedly complete diets of casein, beef muscle, and various seeds in amounts furnishing proteins at levels of from 7 to 61 per cent for the casein, 12 to 72 per cent for the beef muscle, and 18 to 39 per cent for the vegetable proteins. The feeding was continued for various periods ranging from 60 to 480 days. Possibly injury to the kidneys was determined by histological examination and by routine examinations of the urine for casts and albumin during the course of the experiment. Control experiments with liver high in nucleoproteins and with urea were also run.

On the basis of the number of casts in the urine, it was concluded that diets containing 12 and 18 per cent of protein are harmless, that 25 per cent or more cause a small injury if the diet is continued for more than a year, and that 32 and 39 per cent cause the appearance of an abnormally large number of casts in 8 months, the injury becoming slowly more marked in the following 8 months, and that with 75 per cent or more the injury is well established in 8 months.

The examnation of the kidneys showed that the character of the protein was of greater importance than either the concentration of the protein or the duration of feeding. On casein the only injury noted was in the tubules, while on the beef muscle protein the tubular injury was more severe and, in addition glomeruli were injured on the diets containing the higher percentages. Neither the casein nor the beef diets caused changes great enough to alter definitely the gross appearance of the kidneys, but on diets containing 75 per cent of dried liver the outer surface of the kidneys became markedly granular in as short a time as 300 days. The urea diet, which brought about the excretion of urinary nitrogen equivalent to that of a diet containing 40 per cent of protein

when fed for more than a year, caused no enlargement of the kidneys or any injury to them. The authors are of the opinion that the injury observed on the meat diets is due to the specific injurious effect of certain amino acids. Since previous experiments have demonstrated the injurious effects of cystine and tryptophane (E. S. R., 58, p. 293) and since casein is relatively low in these acids and meat proteins relatively high, it is concluded that the difference in the amino-acid make-up of these two proteins is at present the best explanation of their difference in nephrotoxicity.

The conflicting literature on the harmfulness of high-protein diets is reviewed and discussed.

Fatty foods in relation to public health, P. N. WILLIAMS and K. MACLENNAN (*Jour. State Med., 37 (1929), No. 1, pp. 32–45, figs. 6*).—This is a discussion of the qualitative and quantitative requirements for food fats, the estimated shortage of fats in Great Britain, and the possible means of making up for this shortage. It is estimated that the quantitative shortage amounts to about 500,000 tons per annum, and that the qualitative shortage with respect to vitamins A and D is almost as great.

Three possible solutions are suggested: (1) To double the milk production and consumption, (2) to double the butter consumption, and (3) to bring all of the margarine consumed in the country to the same standard of vitamin potency as butter. Of these suggestions the final one is considered the most feasible. Attention is called to the tests of Coward, noted below, of the so-called vitamin margarines as sources of vitamins A and D.

The vitamin content of margarine, K. H. COWARD (*Lancet [London], 1928, II, No. 14, pp. 726, 727, figs. 5*).—Typical results are reported for the examination for vitamins A and D of 14 samples representing four brands of margarine, advertised to contain concentrates of these vitamins, and of the same number of samples of fresh butter, both being purchased simultaneously in ordinary retail shops in London.

The data showed that the margarines were equal to the best summer butter in both A and D and were much more constant in their content of vitamin D than the butters. The average vitamin D content of the margarines was 1.25 units per gram (E. S. R., 59, p. 689). Only one sample of the butter contained as much, most of the samples varying from 0.75 to 1.0 unit.

Biochemical investigation of vitamin B, H. D. KRUSE and E. V. MCCOLLUM (*Physiol. Rev., 9 (1929), No. 1, pp. 126–239*).—Following a historical introduction the authors review the extensive literature on vitamin B under the headings of nomenclature, test methods, properties, attempts at isolation and identification, multiple nature, and bios.

In the discussion of nomenclature, vitamins B and F are recommended for the antineuritic and thermostable factors, respectively, with the suggestion that no generic name be given to the class of dietary factors associated in the water-soluble group. In the present paper, however, the term vitamin B is still used "for the substances effecting cures of polyneuritis and promoting growth in rats, except in the discussion involving its multiple nature, when the proper distinguishing names will be applied to distinctive factors."

A list of 383 references to the literature is appended.

Vitamin B, its nature and its works (*Jour. Amer. Med. Assoc., 92 (1929), No. 7, p. 562*).—Editorial comment on the above-noted review.

Antineuritic and water-soluble B vitamins in beef and pork, R. HOAGLAND (*Jour. Agr. Research [U. S.], 38 (1929), No. 8, pp. 431–446, figs. 7*).—The author has repeated previous work on the antineuritic value, as determined by pigeon-feeding experiments, of beef and pork (E. S. R., 50, p. 859) and has

also determined the content of similar samples of meat in the vitamin B complex by means of feeding experiments with rats. For purposes of comparison, dried yeast was also tested for the antineuritic vitamin and vitamin B.

Dried lean pork was found to compare favorably with dried yeast as a source of antineuritic vitamin, and fresh and smoked ham were equally potent. Beef contained much less of the antineuritic vitamin, from 35 to 40 per cent of dried lean beef being equivalent to 5 per cent of the dried lean pork, these amounts protecting pigeons against polyneuritis and loss in weight for eight weeks and longer.

Lean pork was found to be a good source of the vitamin B complex, although not as good as yeast. From 15 to 25 per cent of the dried pork proved equivalent to about 5 per cent of dried brewery yeast. No material differences were noted between fresh and smoked ham, but beef was much lower in its content of vitamin B than pork, from 40 to 70 per cent being required for growth at the same rate as that with 15 to 25 per cent of the pork.

The vitamin content of vegetables as affected by storage (*Iowa Sta. Rpt. 1928, p. 62*).—Carrots of the Chantenay variety kept in a storage cellar at temperatures ranging from 35 to 45° F. and humidity from 85 to 87 per cent showed no appreciable loss in vitamin B after 24 weeks of storage.

Relation of the altitude of the sun to its antirachitic effect, F. F. TISDALL and A. BROWN (*Jour. Amer. Med. Assoc., 92 (1929), No. 11, pp. 860–864, fig. 1*).—Essentially noted from another source (E. S. R., 59, p. 896).

The transmission of ultra-violet light through tracing cloth, C. H. YOUNG (*Nature [London], 123 (1929), No. 3089, p. 47, fig. 1*).—A brief communication announces that ordinary commercial tracing cloth transmits ultra-violet light to a surprising extent. The transmission is not affected to a marked degree by the thickness of the cloth and number of meshes to the centimeter. In angstrom units the limit of transmission was 2,535 for three samples of the cloth and 2,482 for two others, while the limit of various papers tested lay between 4,339 and 3,125.

Experiments with a thermopile and galvanometer showed that the heat from the sun or from a red-hot ball passed through the tracing cloth to a much less extent than through glass or vita glass. This is thought to be of significance in affording a means of screening off much of the heat and yet retaining most of the ultra-violet light. "A single layer of tracing cloth, between wide-meshed wire screens, can now replace curtains or blinds, and with this screen before an open sunny window it is possible to enjoy the advantages of ultra-violet light without undue heat or glare, although the eyes should be protected. Moreover, for country cottages, chicken farms, etc., it is now possible to obtain a cheap and effective substitute for the many glasses which have been manufactured to secure ultra-violet light in the more beneficial regions of the spectrum."

Effects of massive doses of irradiated ergosterol, I. J. KLEIN (*Jour. Amer. Med. Assoc., 92 (1929), No. 8, pp. 621, 622, fig. 1*).—The feeding for one month to rachitic rats of irradiated ergosterol in doses from 20,000 to 100,000 times the minimum protective dose for rickets led to loss of appetite and weight with impairment of general physical condition and growth. Blood serum analyses at the end of the experiment showed a concentration of calcium 50 per cent higher than that of the control animals and about 24 per cent higher than of animals receiving 2 per cent cod-liver oil. The phosphorus content of the blood of the three groups was about the same. The protein concentration of the serum of the animals receiving ergosterol was lower than that of those receiving cod-liver oil, while the albumin globulin ratio was higher.

The absorption spectrum of vitamin D, T. A. WEBSTER and R. B. BOURDILLON (*Nature [London], 123 (1929), No. 3094, p. 244*).—Evidence obtained with the assistance of R. G. C. Jenkins and C. Fischmann is reported briefly, confirming the previous conclusion (E. S. R., 61, p. 93) that the substance formed from ergosterol on irradiation and showing intense absorption for wave lengths between 2,500 and 2,900 angstrom units is vitamin D. The evidence consists in satisfactory quantitative agreement between the absorption and the antirachitic properties of solutions formed by the irradiation of ergosterol under various conditions, and the formation of substances with no antirachitic properties when ergosterol is irradiated through alcoholic cobalt chloride filters which exclude wave lengths less than 2,600 angstrom units.

Vitamin D and the structure of human teeth (*Nature [London], 123 (1929), No. 3093, pp. 210, 211*).—A review and discussion of the studies of M. Mellanby and her collaborators (E. S. R., 60, p. 593).

The relationship of nutrition to pneumonia in infancy and childhood, L. H. BARENBERG, D. GREENE, and H. ABRAMSON (*Jour. Amer. Med. Assoc., 92 (1929), No. 6, pp. 440–443, fig. 1*).—In connection with attempts to lower the incidence of respiratory diseases, particularly pneumonia, in a large child-caring institution in New York City (E. S. R., 58, p. 896), the authors have determined the state of nutrition of the 505 children who have had pneumonia in this institution during a period of 12 years. Weights taken approximately one month prior to the onset of illness were compared with the standards of the institution, which corresponded closely with those of the U. S. Children's Bureau, and were classified into four groups, overweight, 0 to 10 per cent underweight, 10 to 20 per cent underweight, and 20 per cent or more underweight.

There appeared to be no relationship between the nutrition of the child as thus determined and the occurrence or recurrence of pneumonia. With the possible exception of infants under six months of age, there was no correlation between the state of nutrition and death from pneumonia.

A comparison of the incidence of pneumonia among mildly rachitic and nonrachitic children of the same ages showed an even higher percentage of pneumonia among the nonrachitic than the rachitic children.

Blood regeneration in severe anemia.—XIV, A liver fraction potent in pernicious anemia fed alone and combined with whole liver, liver ash, and fresh bile, F. S. ROBSCHEIT-ROBBINS and G. H. WHIPPLE (*Jour. Expt. Med., 49 (1929), No. 2, pp. 215–227*).—In continuation of the investigation previously noted (E. S. R., 60, p. 695), the authors have tested the value of liver extract No. 343, N. N. R., prepared by the method of Cohn et al. (E. S. R., 59, p. 692), alone and supplemented with whole bile, liver or apricot ash, and small amounts of whole liver, respectively, in the treatment of secondary anemia produced in dogs by repeated bleedings.

The liver extract proved to be relatively inert as compared with whole liver and to be much more variable in its action. Fresh dog bile, which in itself is ineffective in hemoglobin regeneration, added nothing to the effect of the liver extract, but the addition of liver or apricot ash increased the production of hemoglobin to an extent representing the sum of the effects of the two substances given separately. Small amounts of whole liver increased hemoglobin and red cell production in excess of the sum of the expected separate reactions.

Muscle hemoglobin concentration during growth as influenced by diet factors, G. H. WHIPPLE, A. H. GROTH, and F. S. ROBSCHEIT-ROBBINS (*Amer. Jour. Physiol., 87 (1928), No. 1, pp. 185–191*).—Attempts to control muscle hemoglobin formation in dogs by dietary measures similar to those in successful use for blood hemoglobin production (see above) are reported. Litter mates

were divided into two groups and fed after weaning an adequate synthetic bread ration and the same ration supplemented with large amounts of cooked liver. An animal on each of the diets was killed at varying intervals and comparisons were made of the muscle hemoglobin concentration. After 10 weeks' feeding no differences could be noted in the two groups, but after from 15 to 20 weeks those on the liver diet showed higher muscle as well as blood hemoglobin concentration, and after from 25 to 30 weeks the differences were quite marked.

In discussing the difficulty in bringing about changes in muscle hemoglobin the authors contrast the stability of muscle as compared with blood hemoglobin and a probable smaller requirement of the body for muscle hemoglobin, at least for growth.

Blood regeneration in severe anemia.—XV, Liver fractions and potent factors, W. M. Sperry, C. A. Elden, F. S. Robscheit-Robbins, and G. H. Whipple (*Jour. Biol. Chem., 81 (1929), pp. 251–265, fig. 1*).—In continuation of the investigation noted above, various extracts and residues obtained from beef liver with hydrochloric and sulfuric acids and sodium hydroxide and pancreatic and peptic digests of the liver have been tested for their ability to regenerate hemoglobin in the blood of dogs rendered anemic by repeated bleedings. Practically all of the fractions tested were active to a greater or less extent. The alcoholic hydrochloric and aqueous sulfuric acid fractions in some instances contained more than half of the original potency of the whole liver, and some of the alkaline extracts were quite potent, but in spite of repeated efforts the residues could not be freed entirely of potent material. A considerable salt effect was demonstrated in both extracts and residues, suggesting that both organic and inorganic factors are concerned in the liver effect in this type of anemia.

Iodine in Maryland waters in relation to goiter, J. F. McClendon and J. R. Sanford (*Soc. Expt. Biol. and Med. Proc., 26 (1928), No. 3, pp. 263, 264*).—Data are reported on the iodine content of the drinking water of 11 towns in three mountain counties of Maryland and of the City of Baltimore in a tidewater region. In the former the iodine ranged from 0.06 to 1.21 parts per billion while the Baltimore City water contained 5 parts per billion. It is noted that goiter is prevalent in the mountainous region of western Maryland.

Continued administration of iodide and other salts: Comparative effects on weight and growth of the body, P. J. Hanzlik, E. P. Talbot, and E. E. Gibson (*Arch. Int. Med., 42 (1928), No. 4, pp. 579–589, figs. 5*).—Prolonged administration to rats of iodine as sodium iodide in small daily doses over period of time covering from one-seventh to seven-twelfths of the entire span of lif caused moderate though variable increases in weight and growth in th majority of the animals on a complete dietary (Osborne-Mendel) and als on the rachitic diet of Sherman and Pappenheimer. The dosage of iodide corr sponded to what may be used under clinical conditions, but was probably great than that consumed as iodized table salt. In contrast to these results, arsen (Fowler's solution), thallium acetate, and sodium iodide, thiocyanate, bromid and borate administered under the same conditions reduced body weigh checked growth, and, in the case of arsenic and thallium, caused fatalities.

TEXTILES AND CLOTHING

[Studies of wool fibers] (*California Sta. Rpt. 1928, p. 64*).—A new techn for separating macroscopically medulated from nonmedulated animal fibers i volves the immersion of the fiber in a glycerine bath in the presence of subdu

light. Under these conditions the medulated fibers can be seen, while the nonmedulated fibers become invisible to the naked eye.

Studies with the fiber-testing machine indicate that medulated and nonmedulated fibers of the same diameter have the same tensile strength, but that the medulated fibers seem to be seriously lacking in elasticity.

Bleaching of Philippine abaca (Musa textilis): Two methods of raising the grade of Manila hemp, H. E. SHERMAN (*Philippine Agr. Rev., 22 (1929), No. 1, pp. 3-7*).—Two methods are outlined.

HOME MANAGEMENT AND EQUIPMENT

Fuels for cooking purposes in rural homes (*Indiana Sta. Rpt. 1928, pp. 16, 17, 48*).—The results of a survey of fuels used for cooking purposes in 1,400 rural homes in Indiana are briefly summarized.

[Use of electricity in cooking] (*Iowa Sta. Rpt. 1928, p. 62*).—Tests have shown that certain cuts of steak and roasts may be cooked in 3 to 10 minutes by passing a current of electricity through them. Certain vegetables were also cooked very quickly by this method. Meat canned in an electric oven scored higher in flavor that that canned in a pressure cooker, and the cost was less than when the meat was first browned on top of the stove and subsequently canned in a pressure cooker.

MISCELLANEOUS

Report of the [California] Agricultural Experiment Station [1928], E. D. MERRILL (*California Sta. Rpt. 1928, pp. 1+127, pls. 2*).—This contains the organization list, a report of the director and summary of the work of the station for the year ended June 30, 1928, including data as to projects and publications, and a summary, by B. H. Crocheron, of the work of the agricultural extension service (pp. 118-127). The experimental work reported not previously noted is for the most part abstracted elsewhere in this issue.

Forty-first Annual Report of [Indiana Station], 1928, G. I. CHRISTIE and H. J. REED (*Indiana Sta. Rpt. 1928, pp. 83, figs. 27*).—This contains the organization list, a report of the director summarizing the activities of the station, and a financial statement for the Federal funds for the fiscal year ended June 30, 1928, and for the remaining funds for the fiscal year ended September 30, 1928. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

Annual Report [of Iowa Station], 1928, C. F. CURTISS and W. H. STEVENSON (*Iowa Sta. Rpt. 1928, pp. 64*).—This contains a report on the work of the station, including a financial statement for the fiscal year ended June 30, 1928. The experimental work recorded not previously noted is for the most part abstracted elsewhere in this issue. A report by E. W. Lindstrom on Post-War Agricultural Development in Europe (pp. 4, 5) is included.

NOTES

California University and Station.—Dr. E. D. Merrill, dean of the College of Agriculture and directer of the station, has resigned effective December 31 to become director in chief of the New York Botanical Garden vice Dr. N. L. Britton, resigned.

Sabbatical leave has been granted to Dr. H. S. Reed, plant physiologist; Dr. H. S. Fawcett, plant pathologist; and H. J. Quayle, entomologist. Dr. Reed is to investigate various problems in the Mediterranean basin appertaining to citriculture and subtropical horticulture. Dr. Fawcett will make a general survey of the diseases of citrus and the date palm in the same region, and Prof. Quayle will direct the scientific work for the U. S. Department of Agriculture on problems pertaining to the Mediterranean fruit fly in the Mediterranean basin.

Extension director B. H. Crocheron and W. J. Norton, specialist in illustrative material in the agricultural extension service, are making a prolonged study of the situation in Asia and Malay Archipelago in reference to the feasibility of increasing the market for California dried and canned fruits. The work is being done in cooperation with the U. S. Department of Commerce.

Dr. E. L. Overholser, associate pomologist, is also making an official trip to the Orient for the purpose of making a study of the problems of refrigeration of perishable fruits in transit. After returning to California he will report for duty at the Washington College, where he has been appointed professor of pomology and head of the department of horticulture, effective January 1, 1930.

W. P. Duruz, assistant pomologist in the station, has resigned to become professor of pomology in the Oregon College. Asher Hobson of the International Institute of Agriculture at Rome has been appointed professor of agricultural economics and agricultural economist on the Giannini Foundation to develop research in the field of foreign markets with reference to California agricultural products. L. C. Schultz has been appointed assistant crop irrigationist in the station, with headquarters at Davis.

Purdue University and Station.—Sabbatical leave has been granted to O. G. Lloyd, head of the department of farm management, for study at the University of Wisconsin, and to F. P. Cullinan, research associate in pomology, for study at the University of Chicago in plant morphology, plant physiology, and plant chemistry. R. D. Canan, associate in dairy husbandry, has resigned, effective September 1, to engage in commercial work. Recent appointments, effective July 1, include Stephen McQuat Walford as assistant in poultry husbandry extension, C. E. Schumacker as assistant creamery inspector, and Howard O. Deay as instructor in entomology.

Kansas College and Station.—A department of agricultural engineering was created in the station on July 1 with a staff consisting of F. C. Fenton, R. H. Driftmier, and C. A. Logan. The projects to be undertaken by the department include studies of the effect of the method of storing combined wheat upon quality, methods of harvesting and storing grain sorghums, and the effect of the method of harvesting and baling alfalfa hay upon quality.

Two industrial fellowships have been established for the coming year. One of these is by the Association of Operative Millers and provides $540 in the department of milling industry for the purpose of promoting research in milling technology. The second is by the American Cyanamid Company, which established a fellowship of $1,000 with the department of agronomy for the purpose of making a systematic study with calcium cyanamide as a source of nitrogen for wheat under Kansas conditions.

L. E. Melchers, head of the department of botany, who has been on leave of absence for the past two years as chief mycologist for the Egyptian Minister of Agriculture and supervising a pathological survey of the plant crops of Egypt, returned to his former duties on July 1. Dr. J. P. Scott, associate professor of animal pathology, and J. A. Hodges of the department of agricultural economics, who have been on leave of absence for the past year, also resumed their duties on July 1.

Sabbatical leaves for the coming year have been granted to H. H. Laude, associate professor of agronomy, and R. M. Green, professor of agricultural economics, both for graduate work at the University of Chicago, and to Dr. Robert K. Nabours, head of the department of zoology, who is to spend the year as research associate in the department of genetics of the Carnegie Institution at Cold Springs Harbor, N. Y. Dr. Nabours will continue his research upon his present projects, and will study the influence of the use of X-ray and radium on the genetic behavior of the pedigreed grouse locusts. Albert Dickens, a member of the station staff since 1899 and horticulturist and head of the department of horticulture since 1902, has been granted leave of absence for one year because of ill health, to be spent at Albuquerque, N. Mex. R. J. Barnett has been made acting head of the department.

Recent appointments include W. H. Riddell in the department of dairy husbandry vice R. H. Lush, whose resignation has been previously noted, and Lowell R. Tucker in the department of horticulture. F. L. Timmons has been appointed assistant in cooperative experiments in the department of agronomy vice C. O. Grandfield, resigned to accept a position in the Office of Forage Crop Investigations of the U. S. D. A. Bureau of Plant Industry. Mr. Grandfield will continue at the station in a cooperative study in the improvement of alfalfa from the standpoint of resistance to bacterial wilt.

H. E. Myers has been appointed assistant agronomist vice E. S. Lyons, and R. O. Lewis assistant in the soil survey vice R. H. Davis, both of these resignations being occasioned by acceptance of positions with the U. S. D. A. Bureau of Chemistry and Soils. E. H. Coles, associate agronomist in dry land agriculture of the Office of Dry Land Agriculture, U. S. D. A. Bureau of Plant Industry, at Garden City has been appointed superintendent of the Colby Substation vice B. F. Barnes, resigned to accept the superintendency of the Dalhart, Tex., Field Station.

C. J. Whitnah has been appointed associate in feeding stuffs analysis in the department of chemistry vice R. W. Titus, resigned to accept a commercial position. C. G. Dobrovolny has been appointed technician in the department of zoology vice C. A. Gunns, resigned to accept a similar position in the University of California.

Louisiana University and Stations.—An experimental feeding shed has been completed for work with beef cattle and sheep, including digestion trials. A new seed house for the use of the department of crops makes generous provision for the storing of experimental cotton, corn, and other seeds. A large brooder house is in process of construction, containing a room which can be used for taking care of small chickens in the brooders and also provides incubator space. Plans have been drawn for two of the three buildings that will ultimately form

the animal pathology group, and it is expected that these buildings will be ready for use by January 1, 1930.

C. L. Osterberger, specialist in farm mechanics, has resigned to accept a commercial position and has been succeeded by H. T. Barr, assistant professor of agricultural engineering and assistant agricultural engineer in the Arkansas University and Station. H. H. Flor, assistant plant pathologist, has resigned to accept a position with the U. S. D. A. Bureau of Plant Industry and will be succeeded by L. Persons.

Michigan College and Station.—Leo M. Geismer, superintendent of the Upper Peninsula Substation at Chatham from its establishment in 1900 until 1911, died July 16 at the age of 75 years. He was a native of Germany and studied at the State Normal Agricultural College at Colmar, France, coming to this country when 22 years of age to engage in farming. In 1912 he became special State extension agent for the Upper Peninsula, and since 1919 had been county agent of Houghton County.

The appointments are noted of J. H. Muncie as research associate in plant pathology, effective September 1, vice G. H. Coons, resigned, and H. H. Blakeslee as part-time extension and part-time research specialist in animal industry for work in connection with the Upper Peninsula Substation.

Mississippi College and Station.—George S. Templeton, head of the animal husbandry department for the past six years, has resigned as of August 31 to accept a position with the educational bureau of the National Cottonseed Crushers Association. D. S. Buchanan, professor of animal husbandry and associate animal husbandman, has been appointed head of the department, and the resulting vacancy filled by the appointment of R. H. Means.

New Jersey Stations.—The resignations are noted of Frank S. Beckwith, fertilizer and feed sampler; Dr. Oliver N. Massengale, poultry nutrition specialist; Mary Ellen Peck, assistant seed analyst; Helen Powell, assistant clothing specialist; Ralph A. Ingalls, research assistant in plant physiology; and Arthur L. Stahl, laboratory assistant and legume inoculation analyst. Recent appointments include William H. Baumgartner as research assistant, Morris S. Fisher as junior chemist, and Gerald M. Ridenour as research engineer.

Cornell University and Station.—A gift of $1,500,000 has been tendered the university by the General Education Board upon the condition of its duplication by the university within one year. The sum thus made available is for the purpose of establishing a foundation for research which ultimately will require $9,000,000. The plan under consideration contemplates the strengthening of research in physics, chemistry, and biology by the creation of a center of research in general physiology. A recent statement by the president of the university announces that the formulation of this plan was based mainly on the outstanding contributions to biological science made by the College of Agriculture.

In connection with the additional funds for specific pieces of research authorized by the last legislature, Dr. James E. Knott, professor of vegetable gardening in the Pennsylvania College and Station, has been appointed research assistant professor in the department of vegetable gardening to investigate vegetable production problems on muck soil. Allen G. Newhall, assistant plant pathologist in the Ohio Station, has been appointed research assistant professor of plant pathology for work on the diseases of muck crops. Frank F. Hill of the Federal Land Bank at Springfield, Mass., has been appointed assistant professor of rural economy to take up economic studies of rural government.

On April 1 there was established a special temporary fellowship of the American Rose Society for the investigation of the diseases of roses. This

fellowship extends for a period of two years and carries a grant of $1,250 per year from the society. Effective also on April 1 there was executed a special temporary fellowship agreement with the Nassau County Farm Bureau Association for the conduct of investigations having to do with the diseases of truck crops. This fellowship extends for a period of two years and carries an annual grant of $1,200 from the association. Still another grant of $3,500 a year has been made available from funds of the State Department of Agriculture and Markets to enable the station to continue its study of fruit diseases in the Champlain Valley.

Arrangements have been completed and funds made available for the establishment of an animal nutrition research laboratory and additional field buildings in the experimental orchard and at the experimental vegetable gardens. Rapid progress is being made on the erection of the plant industry building, which when completed will cost a little in excess of $1,000,000 and will house the department of botany, plant pathology, plant breeding, pomology, floriculture, and ornamental horticulture.

Dr. H. H. Love, professor of plant breeding, has been spending the spring and summer at the University of Nanking in furtherance of the Cornell-Nanking plant improvement project.

New York State Station.—Following an appropriation by the legislature of funds for the drawing of plans, the State architect's office has begun work on the plans and specifications of the proposed laboratory building to be erected in the near future.

P. J. Parrott, chief in research (entomology), has been appointed vice director of the station and will continue as head of the entomology division. Effective July 1, Dr. B. R. G. Nebel has been appointed associate in research (horticulture); Dr. Z. I. Kertesz assistant in research (chemistry); Dr. G. E. R. Hervey associate in research (entomology), chiefly for investigations on corn borer control in the sweet corn areas of the State; and Frederick Borg librarian vice Viola Elver, resigned to accept a position with the animal husbandry department at Cornell University. Karl D. Brase has been appointed assistant in research (horticulture) and has entered upon his duties. R. C. Collison, chief in research (agronomy), and J. D. Harlan and P. V. Traphagen, assistants in research (agronomy), have been transferred to the division of horticulture, with titles of chief, assistant in research (orchard soil investigations), and assistant in research (horticulture), respectively.

J. E. Mensching, associate in research (agronomy), resigned effective July 1 to engage in business. W. P. Wheeler, associate in research (animal husbandry), retired on the same date after 41 years of service with this station.

Pennsylvania College and Station.—The resignations are noted of M. F. Grimes, professor of animal husbandry, on July 10; W. S. Krout, professor of plant pathology extension, on April 1; H. S. Newins, professor of wood utilization, on July 15; Raymond J. Miller, associate professor of agricultural and biological chemistry, on September 1; C. A. Sorg, assistant professor of ornamental horticulture, on June 30; H. N. Watenpaugh, instructor in agronomy, on June 30; and A. P. Tuttle, assistant in vegetable gardening, on June 30. Recent appointments include John E. Nicholas as associate professor of farm machinery on July 1, Dr. Jesse E. Hunter as assistant professor of agricultural and biological chemistry on September 1, Lewis C. Chadwick as assistant professor of ornamental horticulture on September 15, Alfred F. Cooke, jr., as assistant in floriculture on March 15, and K. P. Dozois as assistant in bacteriology on August 1.

West Virginia University and Station.—Dr. C. R. Orton of the Boyce Thompson Institute for Plant Research has been appointed professor and head

of the department of plant pathology in the university and plant pathologist in the station. He succeeds N. J. Giddings, head of the division of plant pathology, resigned to undertake an investigation for the U. S. Department of Agriculture on curly top, with headquarters at the California Citrus Experiment Station.

Wisconsin University and Station.—A fund of $3,000 per annum for three years has been tendered by the American Cyanamid Company and accepted by the board of regents. This fund will provide for a study of the use of calcium cyanamide as a source of nitrogen in connection with the so-called Hohenheim system of pasture management. The work is to be carried on jointly by the department of agronomy and soils, with J. A. Elwell as industrial fellow.

Dr. William H. Wright, associate professor of agricultural bacteriology and agricultural bacteriologist in the station, died May 3 at the age of 44 years. Although a native of Indiana and a graduate of Purdue University, Dr. Wright had subsequently been connected with the University of Wisconsin, from which he received the M. S. degree in 1909 and the Ph. D. degree in 1924. He had been associated with the bacteriological work of the institution for 20 years, and with Dr. E. G. Hastings was the author of Laboratory Manual of General Agricultural Bacteriology.

John A. Commons has been appointed assistant in agricultural economics, and W. H. Tharp industrial fellow in plant pathology.

Plans for a feed storage building have been accepted and construction is under way.

Federal-State Committee on Soil Erosion.—This committee, appointed by Dr. A. F. Woods, director of scientific work of the U. S. Department of Agriculture, to develop a national program for the control of soil erosion and to set up erosion prevention and moisture conservation stations on 18 erosion areas over the country under a congressional appropriation of $160,000, has the following personnel: Chairman, Dr. A. G. McCall, chief of soil investigations, U. S. D. A. Bureau of Chemistry and Soils; S. H. McCory, chief of the division of agricultural engineering, U. S. D. A. Bureau of Public Roads; Dr. E H. Clapp, assistant forester in charge of research, U. S. D. A. Forest Service; Dr. J. G. Lipman, director of the New Jersey Experiment Stations; and A. B. Conner, director of the Texas Experiment Station.

Prize for Improving Agriculture in the Punjab.—Some years ago a gift of 25,000 rupees by the late Sir Ganga Ram of Lahore was made to the Punjab Government for the endowment of a prize to be awarded for the discovery or invention of a practical method which would tend to increase the profitable agricultural production of the Punjab. This prize, valued at 3,000 rupees and known as the Maynard Ganga Ram Prize, may be awarded every three years if proposals of sufficient merit are received. A world-wide competition is provided, and the date for the current competition has been extended to December 31, 1929.

Necrology.—Dr. George C. Creelman, president of the Ontario Agricultural College from 1904 to 1920 and prominently identified with Canadian agricultural and educational leadership during the World War, died April 18 at the age of 60 years. Dr. Creelman was a native of Ontario, a graduate of Toronto University in 1888, and a recipient of the honorary degree of doctor of laws from McMaster University in Toronto in 1910. From 1889 to 1897 he was professor of biology in the Mississippi A. and M. College, from 1898 to 1904 superintendent of farmers' institutes in Ontario, from 1917 to 1920 Ontario commissioner of agriculture, and from 1920 agent general for Ontario in Great Britain and continental Europe until retiring in 1921 on account of ill health.

He had served as secretary of the American Association of Farmers' Institute Workers from 1900 to 1906, as president of the same association in 1906, as the Canadian delegate to the International Institute of Agriculture at Rome in 1907, and as the president of the Canadian Society of Technical Agriculturists in 1926–1927.

Dr. Harry C. Frankenfield, meteorologist in charge of the river and flood division of the U. S. D. A. Weather Bureau, died July 29 from injuries received in an automobile accident. Dr. Frankenfield was born in Easton, Pa., on November 24, 1862, and entered the meteorological service of the United States, then under the signal corps of the Army, in 1882. His outstanding contribution to meteorology was the development of numerical computations by which flood stages at various places can be closely foretold days to weeks in advance from existing conditions upstream. He was the author of numerous bulletins of the Weather Bureau and a considerable number of articles in the *Monthly Weather Review*.

Dr. Peter A. Yoder, associate technologist in the sugar cane investigations of the U. S. D. A. Bureau of Plant Industry, died July 19. Dr. Yoder was a native of Indiana and graduated from the University of Indiana in 1894. He received the A. M. degree from the same institution in 1896 and the Ph. D. degree from Göttingen University in 1901. He had served as associate professor in chemistry and associate chemist in the Utah College and Station from 1901–1905, as professor of chemistry and director of the Utah Station from 1905–1907, and as research chemist of the Louisiana Stations in 1908–1910.

Clarence B. Lane, assistant chief of the dairy division of the U. S. Department of Agriculture from 1903 to 1909 and earlier associated with the dairy work of the Connecticut Storrs and New Jersey Experiment Stations, died August 20 after a long illness. He was born in Killingworth, Conn., January 6, 1870, and graduated from the Massachusetts Agricultural College in 1895. After leaving the U. S. Department of Agriculture he was engaged for many years in commercial work and was the author of The Business of Dairying, published in 1909.

A recent issue of *The Agricultural Journal of India* announces the death on January 17, of Dr. G. S. Zaitzev, the Russian geneticist and plant breeder, "whose work on the botany and physiology of the cotton plant has achieved a very wide reputation."

Miscellaneous.—*Nature* states that on July 19 Sir Thomas Middleton unveiled at Dishley Grange in Leicestershire a memorial to Robert Bakewell (1725–1795), the pioneer of stock breeding improving. Funds for this memorial were contributed from Canada and the United States as well as the British Isles.

Dr. Jewell B. Knight is to spend several months in Nicaragua as a representative of the Tropical Plant Research Foundation and will prepare a plan for an agricultural school and experiment station which the Government of Nicaragua hopes to establish.

H. F. Murwin, agent in charge of the work of the Bureau of Plant Industry on tobacco and plant nutrition in the Connecticut Valley, has been appointed director of the tobacco station at Harrow, Ont., and entered upon his duties about May 1.

Dr. F. T. Wahlén, chief seed analyst in the Dominion Seed Branch, has accepted an appointment as director of the Swiss Agricultural Control and Experiment Station at Oerlikon, Zurich, Switzerland, beginning October 1.

EXPERIMENT STATION RECORD

VOL. 61 OCTOBER, 1929 No. 5

The second member of the long awaited trilogy of historical monographs from the pen of the late Dr. A. C. True has now become available. This volume is entitled A History of Agricultural Education in the United States, 1785–1925, and it covers in a general way the entire movement in this country. Like its predecessor in the series, which dealt with the extension movement and was reviewed in these columns some months ago, it is thoroughly permeated with the spirit of its author. It is invaluable not only because of the large amount of information which it brings together, but because its data have been so thoroughly sifted and weighed by a master hand, exceptionally qualified by sound scholarship, a broad viewpoint, and an intimate acquaintance with the subject matter.

In attempting his account of the evolution of agricultural education in this country, Dr. True has skillfully avoided a narrow limitation of his theme. As he makes clear in the preface, "to understand the movement which has resulted in the broad development of agricultural education in this country it is necessary that its relation be shown to the general development and progress of science and education and to the background of economic conditions and of organizations of various kinds for the promotion of agriculture and country life." Considerable attention has therefore been given to these factors, particularly as related to the earlier stages of agricultural education. This has been fortunate, for it has served to orient the subject and to enable the reader to trace the growth of this phase of education not as the haphazard happening of isolated events but as an orderly and more or less closely related sequence which has steadily though not uninterruptedly tended toward the upbuilding of a great national system.

Another conspicuous service which Dr. True has rendered in this book is in the discovery and presentation of much new historical material. He has not been satisfied with a mere rechronicling of what has already been assembled by others, but has delved patiently and persistently into the original records of the past. Mention is made in an appended bibliography of no fewer than 557 references to works which have contributed to the history, and there is reason to believe that this number represents only a fraction of those which were consulted. Many of these references are from relatively ob-

scure sources, and the net result has been the unearthing of many facts which have hitherto been practically buried and unknown. This condition has been especially true as regards the beginnings of agricultural education, and it is upon this period that the greatest new light has been thrown. Nearly one-fourth of the approximately 400 pages of the book deals with matters prior to the passage of the original Morrill Act of 1862. Even this amount of space represents considerable condensation and some omissions from the original manuscript, but it embodies by far the most complete account of developments during this era ever printed, and makes available a store of information which can not fail to be of great value to every student of agricultural education and to many others.

Dr. True traces the beginnings of agricultural education in this country to the conditions prevailing at the close of the Revolutionary War. With independence assured, there was begun in the unoccupied regions of the original Colonies and even beyond the Alleghenies "a vast expansion of American agriculture and the building up of rural communities largely unhampered by traditions and willing to undertake experiments in agriculture, education, and social organization. Meanwhile the older settlements along the Atlantic coast had followed a crude and exhausting practice of agriculture and were seeking means of increasing the fertility of their lands. . . . The dispersion of farm laborers and the increasing size of farm operations made the necessity for improved farm implements more and more apparent. Under such circumstances it was natural for political and social leaders to take a deep interest in the promotion of agriculture, and to connect this closely with the promotion of commerce, manufactures, and the arts."

Simultaneously with the increased interest along these lines came a renewal of contacts with Europe and additional information as to European affairs. It so happened that "the eighteenth century in Europe had been marked by the establishment of a number of agricultural societies and schools, in connection with which agriculture was taught and practiced. Books and pamphlets on agricultural subjects were quite numerous. Knowledge of these things was available in North America and greatly influenced the origin and progress of the movement for agricultural advancement in the United States." Also the movement for agricultural schools and colleges in the United States was intimately associated with the growth of the natural sciences and their applications in Europe and the appreciable number of men either residents or travelers in this country who devoted themselves to scientific work in natural history and related lines.

Much of this activity found expression through the early agricultural societies, and Dr. True, like Dr. Bailey in his classic account

in 1909 of the history of agricultural education in his Cyclopedia of American Agriculture, gives large credit to these organizations as leading agencies for the development of an ever increasing body of public opinion favorable to agricultural education and research. He also discusses the beginnings of public aid to education and its bearings on agriculture, and mentions the project indorsed by Washington and others for a national university. Of particular interest in this connection were the somewhat detailed plans for such a university put forward by Dr. Benjamin Rush of Philadelphia in 1787 and 1788, under which the subjects to be taught were to include "agriculture in all the numerous and extensive branches," as well as "those parts of natural philosophy and chemistry which admit of an application to agriculture."

More tangible was the appointment of Samuel Latham Mitchell, prominent in the New York Society for the Promotion of Agriculture, Arts, and Manufactures, as professor of natural history, chemistry, and agriculture in Columbia College in 1792 through the use of State funds for additional professorships, and the establishment in Harvard College in 1804-5 and maintenance for 25 years of a professor of natural history and a botanic garden by the Massachusetts Society for Promoting Agriculture. Other achievements by the societies are reviewed, and it is stated that with the new century "the agricultural societies became more democratic and brought a considerable and growing body of the most intelligent and progressive farmers into active relations with a nation-wide movement for the advancement of agriculture. Through meetings, fairs, correspondence, publications, and articles in the agricultural and other papers they sought to make the pnblic feel that the interests of agriculture and farming population were entitled to more consideration by Congress and the State legislatures. They were increasingly active and influential in the efforts to establish State boards of agriculture, a national Department of Agriculture, the teaching of agriculture in schools and colleges, the carrying on of experiments and scientific investigations for the improvement of agriculture, and the building up of agricultural journals and books."

Meanwhile efforts continued here and there to provide agricultural training through private institutions. Some of these were merely manual labor schools, but in some institutions the application of the natural sciences to agriculture or the theory and practice of agriculture itself was combined with practical work in fields and shops and instruction in the usual academic branches. Among these were the Gardiner (Me.) Lyceum (1823–1832), the Agricultural Seminary at Derby, Conn. (1824), and the Cream Hill Agricultural School at West Cornwall, Conn. (1845–1869). These schools varied greatly in scope, but in general their agricultural instruction was superficial

and temporary. "They are, therefore, chiefly interesting," says Dr. True, "as showing a more or less earnest purpose to give agriculture a pedagogical status by uniting theory with practice in the school curriculum and to satisfy the demand of a considerable number of the more intelligent farming people of that day that in some way agriculture should reap the benefit of advancing knowledge regarding the phenomena and laws of nature. They were premature developments, because there was not yet a body of knowledge relating to agriculture which could be successfully used in secondary schools. As experimental ventures in education they served, however, to stimulate the movement which was to result in the establishment of agricultural colleges and experiment stations."

In 1824, the Rensselaer Institute at Troy, N. Y., was opened "to qualify teachers for instructing the sons and daughters of farmers and mechanics in the application of experimental chemistry, philosophy, and natural history to agriculture, domestic economy, the arts, and manufactures." Under the tutelage of Amos Eaton, professor of chemistry and experimental philosophy and lecturer on geology, land surveying, and the laws regulating town officers and jurors, this institution, which subsequently became the well-known Rensselaer Polytechnic Institute, exercised a considerable influence on the movement for scientific education relating to agriculture, and at least three of its students later became associated with its beginnings under State auspices in Iowa, Wisconsin, California, and New Jersey. Other developments in purely private institutions included an agricultural establishment at Washington College (now Trinity) at Hartford, Conn., in 1824; the listing by Amherst College in 1843 of a lecturer on agricultural chemistry and mineralogy and a scientific department "entirely independent of the regular course" in 1852 with J. A. Nash as instructor in agriculture; and the Farmers' College at College Hill, Ohio, organized in 1846 and with 330 students a decade later.

None of these enterprises proved permanently successful, partly for financial reasons, and friends of agricultural education began to look toward State aid for such institutions. In New York, under the leadership of Jesse Buel, John Delafield, Amos Brown, and others, some success attended these efforts, though only to meet with disaster during the Civil War. Somewhat similar experiences were had in Ohio, Massachusetts, Wisconsin, and Georgia, but in Michigan, Maryland, and Pennsylvania, institutions were established which have continued without interruption, though with some changes of scope and policy.

Special attention is naturally given in the book to the national aspects of the movement for the development of education relating to agriculture and other industries. Dr. True notes that as early as 1838 Charles L. Fleischman, a naturalized citizen from Bavaria and

a graduate of the Royal Agricultural School of that country, urged in a memorial to Congress that schools be established in which, among other subjects, instruction would be given in agriculture in all its branches. Three years later came a memorial from Capt. Alden Partridge, president of Norwich University in Vermont, with what is called "the first definite proposition made to Congress for the use of the proceeds of the sale of public lands on a large scale for distribution to the States in proportion to their representation in Congress for the endowment of new or old institutions in which there should be a broad curriculum, including the natural and economic sciences with their applications to agriculture, engineering, manufactures, and commerce, as well as military science and practice, in order that American youths might have an education which would make them more efficient farmers, engineers, mechanics, or business men." The elaborate plan of Prof. Jonathan Baldwin Turner for an industrial university in each State, first presented in 1851 and supported by a resolution of the Illinois Legislature in 1853 asking for a grant to each State of public lands not less in value than $500,000 for a system of industrial universities "for the more liberal and practical education of our industrial classes and their teachers," is discussed at length, as is also the important influence of the United States Agricultural Society along these lines.

Senator Morrill's connection with the movement is described from his introduction into Congress in 1856 of a resolution asking that the House Committee on Agriculture inquire into the expediency of establishing one or more national agricultural schools where "one scholar from each congressional district and two from each State at large may receive a scientific and practical education at the public expense." This resolution met with objection, and on December 14, 1857, he introduced the first college land-grant bill. This was the measure which was vetoed by President Buchanan on February 26, 1859, and in slightly revised form it became in due season the First Morrill Act, signed by President Lincoln on July 2, 1863. Concerning the genesis of this measure, about which much controversy has waged, Dr. True refers to the fact that for some years "petitions were coming to Congress for land grants for agricultural colleges in different States." Specifically, he concludes that the Senator must have known about that of Capt. Partridge, a neighbor with whom he had had many contacts, and he gives reasons why "it seems probable that Mr. Morrill knew about Turner's proposition." In Dr. True's opinion, it may be true that Senator Morrill personally "did draft his bill, and he deserves very great credit for its form and for the masterly way in which he brought about its passage. . . . Morrill's measure was in fact the culmination of the long movement for agricultural and technical schools

. . . , and it is altogether likely that Morrill derived the ideas incorporated in the bill from various sources connected with that movement."

As would be expected, Dr. True devotes the great bulk of his book to the story of the development of agricultural instruction since the passage of the Morrill Act of 1863. He does not attempt a detailed history of each institution, but has selected typical examples which bring out the various phases of the movement. In many cases he has summarized the principal events by periods in a very constructive and helpful way.

In speaking of the first decade and its limited student enrollment, Dr. True points out that "it had proved particularly difficult to construct good agricultural courses. The teaching of chemistry, botany, and zoology and their relations to agriculture, and of practical systems of agriculture, principally by means of lectures, had been combined with manual labor on the college farms, which for the most part had had comparatively little educational value. The development of laboratory work in the natural sciences in which the students participated and the direction of the study of the sciences toward their applications to agriculture and other useful arts had thus far been the chief educational contribution of the land-grant colleges. The need of experimental inquiries to develop a body of scientifically tested knowledge which might be used as a basis for more thorough and satisfactory instruction in agriculture was beginning to be apparent. . . . These colleges were also about to show that while their systematic courses in agriculture were weak they could broadly aid agricultural progress by their contacts with large numbers of adult farmers in their societies and farmers' institutes and through the agricultural press."

Economic conditions continued to play havoc with the colleges during the succeeding period from 1873 to 1887. Overproduction of agricultural products by comparatively crude methods and the depression of agricultural values he cites as reasons which deterred young men from entering the agricultural courses. Also there was at that time "little systematic effort to improve agricultural instruction pedagogically or systematically. Each teacher of agriculture very largely went his own way. Courses were often arranged to catch students or to meet the needs of young, ill-organized, and poorly equipped institutions. In many of the land-grant institutions the agricultural departments were completely overshadowed by the popular courses in engineering, general sciences, and liberal arts. Nevertheless, agricultural instruction was broadened in scope, and the way was opened for the great and rapid development which was soon to follow." There was likewise perceptible progress in the development of experimental work and a great increase in the avenues of

approach by the colleges to the farmers. "While the farmers were very often discouraged by their difficult situations in this period and therefore were not inclined to have their sons study in the agricultural courses of these colleges, they nevertheless wanted all the helpful information these institutions could give them. The general influence of the land-grant colleges among the farming people was therefore much strengthened and widened."

Dr. True consistently attributes the tremendous advances in agricultural education during the present century to the development of research and the improvement in content and methods of instruction. Most of the details pertaining to the upbuilding of the experiment stations he reserved for the final volume of his series, now awaiting publication, but much space was given to what was done to develop adequate courses in agriculture and strengthen the pedagogic methods, equipment, and personnel of the instruction staff. Much credit is accorded the Association of American Agricultural Colleges and Experiment Stations, now the Association of Land-Grant Colleges and Universities, for its influence and efforts in these directions.

As one specific agency for progress, Dr. True warmly commends the work of the Graduate School of Agriculture, stating that "there has been nothing to take its place as a meeting place for officers of colleges and stations and advanced students from the whole country to discuss at some length vital problems of agricultural education and research. It is believed that the graduate school had much influence in stimulating the establishment of more thorough agricultural courses in the land-grant colleges based on the science of agriculture broadly considered and on the sciences related to agriculture. It also promoted the raising of standards for the undergraduate courses and the institution of regular graduate work. It showed the necessity of thorough training for agricultural teaching and research. At the same time it aided the development of research and extension work in agriculture and the spread of agricultural teaching into the secondary schools. In a way its courses and conferences represented the progress of the movement for a broader and better American system of agricultural education and research. Its membership, drawn so widely from different parts of the country, carried its influence throughout the land-grant colleges, and it thus furnished much material for the discussion of curricula, methods of teaching, lines of research, organization and conduct of extension work which went on in these institutions during the period of its existence."

Regarding the general status of the agricultural colleges in 1925, the date at which the history ends, Dr. True speaks in final summary in part as follows: "Since 1915 the work of the agricultural colleges in the United States has been greatly broadened and

strengthened. The organization of these institutions has also been more sharply defined so as to make the major lines of work distinct as (1) research (mainly through experiment stations), (2) resident graduate and undergraduate teaching, and (3) extension work. In all these lines the work has gone beyond that which relates to agricultural production and now includes a considerable range of subjects in rural economics and sociology.

"The general character of these institutions as public agencies for the promotion of agriculture and country life has also undergone considerable modification. This is shown not only by the recent Federal and State legislation affecting them financially or otherwise but also by the closer and wider relations which they have with the Federal Government, State organizations, local communities, and great numbers of individuals in all parts of the several States. . . .

"Resident teaching in the agricultural colleges has been greatly strengthened and diversified in recent years. About $10,000,000 is now annually spent for agricultural instruction in the land-grant colleges. The courses in the various branches of agriculture have in general become more highly specialized and technical. Strong emphasis is now being placed on courses in rural engineering, rural economics, and sociology. Special attention is being paid to better organization of the curriculum, the adoption of a group system of electives, provisions to meet the needs of individual students according to their interests and capabilities, promotion of better teaching, and recognition of the importance of expert supervision of the educational work as a whole by the appointment of directors of resident teaching or similar officers."

Final chapters of the history deal in turn with secondary education in agriculture, 1862–1925, and agriculture in the elementary schools. These chapters embody much data of interest to all who are concerned with the history of these phases of agricultural education.

The foregoing summary necessarily leaves unmentioned many of the important matters covered by Dr. True, but it may perhaps be of service in indicating the general method of treatment, something of its scope, and a touch of its sympathetic spirit. That the monograph will take high rank and be in great demand as an authoritative work of reference seems assured. Because of its size and numerous illustrations and the consequent high cost of publication, the number of copies available for free distribution is far too small to attempt to meet the needs of individuals. The edition which has been printed for sales purposes is also limited, and early purchases may be advisable to avoid disappointment.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

The mineral content of grains, J. E. Greaves and C. T. Hirst (*Utah Sta. Bul. 210 (1929), pp. 38*).—The ash content of growing wheat, oats, barley, and corn was found to have been increased, respectively, 46, 31, 36, and 8 per cent by the application of optimum quantities of irrigation water, while manure applications also increased the ash content of the grain kernel 6 per cent. The effect of the irrigation water in causing increases in ash content reached a maximum and thereafter fell off with further increases in the water application, the tentative explanation offered by the authors of this communication being indicated in the statement that "it may be that the irrigation water has increased the bacterial activities of the soil, which results in a greater production of acids within the soil. These react with the insoluble plant food and render it more available to the plant, which in turn means that more is taken up by the growing plant and results in the noted increased ash content. When the application of irrigation water exceeds a certain optimum, the bacterial activity may be decreased, or where there is an increase the heavy applications of irrigation water may carry the plant food below the feeding area of the plant; consequently, there is a loss of fertility without an increased crop yield or an increase in its ash content."

Determinations of the ash content of grains from various parts of the State indicated wide ranges of variation, the ash content of the wheats, for example, being reported as having been found to show a variation of 118 per cent, barley 78 per cent, and oats 185 per cent.

As an illustration of the effect upon individual elements in the ash said to have resulted from irrigation, it is stated that "irrigation-grown wheat, barley, oats, and corn contain 157, 40, 22, and 38 per cent more calcium than corresponding nonirrigated grain." In magnesium content wheat is stated to have been increased by the irrigation 32 per cent, oats 65 per cent, barley 9 per cent, and corn nil, with much wider variations in the State as a whole. Similar statements are made with respect to the contents of potassium, phosphorus, and sulfur in the grains mentioned. With respect to iron the finding was that "the iron content of wheat, oats, and barley varies greatly, depending upon the locality, variety, and irrigation water applied during the growing season."

New contributions to the question of the denaturation of proteins, I [trans. title], M. Spiegel-Adolf (*Biochem Ztschr., 204 (1929), No. 1-3, pp. 1-13*).—An investigation was made of the conditions under which electrolyte-free serum albumin, ovalbumin, and pseudoglobulin are precipitated by alcohol, as well as of certain properties, also, of the precipitated product.

In contrast with the behavior of serum albumin, according to the results here reported, pseudoglobulin which had been precipitated from aqueous solution by heat was restored only partially to a condition of solubility in water by subsequent treatment with alkaline solutions. Even by the use of a higher

final concentration of alcohol (up to 88 per cent) with an increase in the time of treatment to as much as six weeks, only some 60 to 70 per cent of the serum albumin so treated was found to be rendered insoluble in water; moreover, the fraction which had been thus insolubilized could, by treatment with suitable quantities of alkali solutions, followed by electrodialysis, be brought back to solubility in water and the typical properties of serum albumin. The restoration of solubility in water in the case of ovalbumin precipitated by alcohol, as above noted, and subsequently treated with alkaline solutions is described as having been practically undetectable. Both in precipitation and in resolubilization, pseudoglobulin took an intermediate position between the other two proteins under investigation. The presence of acids in certain concentrations is said to have doubled the quantity of serum albumin remaining water-soluble in the alcohol treatment. The presence of neutral salts in the alcohol treatment was found, as in the case of the heat denaturation, to prevent almost entirely the restoration by alkalies of the solubility in water of serum albumin.

The similarity between alcohol and heat-denaturation and the significance of these phenomena in relation to the general reaction underlying protein denaturation are discussed.

Some chemical studies of commercial bacteriological peptones, J. G. McAlpine and G. D. Brigham (*Jour. Bact., 16 (1928), No. 4, pp. 251–256, fig. 1*).—This contribution from the Connecticut Storrs Experiment Station describes an investigation of the forms of nitrogen, including total nitrogen, nonprotein nitrogen, free ammonia, amino nitrogen, protein nitrogen, and polypeptide nitrogen, found in four brands of commercial peptones. The total nitrogen content of all four brands was found to be practically the same, but in the quantities of the various nitrogen fractions a marked difference was observed. It had been noted in the study of certain groups of bacteria that some of the commercial peptones were better suited for the growth and multiplication of the organisms than were others, and it was the purpose of the work here described to ascertain what forms of nitrogen would best be utilized by bacteria of the *abortus-melitensis* group.

On the precipitation of casein at its isoelectric point [trans. title], F. Lebermann (*Biochem. Ztschr., 206 (1929), No. 1–3, pp. 56–59*).—The author calls attention to the fact noted by others (E. S. R., 60, p. 613) that the buffering power of cow's milk is so great that in attempting the precipitation of casein at its isoelectric point this buffering effect must be taken into consideration. He states as his conclusion that the optimal precipitation of casein from skim milk is to be secured by the use of an acetic acid-acetate buffer mixture of a pH value of 3.74. It is noted that the casein is thus precipitated at a pH value (4.89) somewhat higher than that (4.7 approximately) at which pure casein is best precipitated. Some results of experiments with various acetate buffers are given.

Chemical constitution and germicidal activity of amines, ketones, and aldehydes, F. W. Tilley and J. M. Schaffer (*Jour. Bact., 16 (1928), No. 4, pp. 279–285*).—Continuing previous work on the germicidal activity of soap-cresol solutions (E. S. R., 54, p. 393), on that of the monohydric alcohols and phenols (E. S. R., 56, p. 572), and on that of other alcohols and phenols (E. S. R., 58, p. 274), the authors of this contribution from the U. S. D. A. Bureau of Animal Industry have now determined phenol coefficients for methyl methyl ketone, methyl ethyl ketone, methyl *n*-propyl ketone, methyl *n*-butyl ketone, methyl *n*-amyl ketone, *n*-propylamine, *n*-butylamine, *n*-amylamine, *n*-hexylamine, *n*-heptylamine, diethylamine, di-*n*-propylamine, di-*n*-butylamine, triethylamine, benzylamine, aniline, paratoluidine, methyl aniline, ethyl aniline, formaldehyde,

acetic aldehyde, propionic aldehyde, and butyric aldehyde, using as test organisms *Bacillus typhosus* and *Staphylococcus aureus*.

The results indicate that "with *B. typhosus* as the test organism the average ratios between successive molecular coefficients vary somewhat with different strains, the general average ratio with all strains being approximately 2.0. With *S. aureus* as the test organism the ratios also vary somewhat with different strains, but the general average ratio with all strains is approximately 3.3. Results obtained with alkyl ketones indicate that with *B. typhosus* as the test organism the average ratio between successive molecular coefficients is 3.25. Results with the aldehydes were not such as to yield a satisfactory ratio for the series, although they suggest that this ratio may be 2.5 or more."

The ortho-tolidine test for free chlorine as an indicator of safety in the swimming pool, W. L. MALLMANN (*Michigan Sta. Rpt. 1927, pp. 293–295*).—By the use of orthotolidine as a test for the presence of free chlorine in the water of a swimming pool it was found that the presence of from 0.1 to 0.2 part per million of free chlorine, as indicated by the test named, was adequate to prevent the presence of microorganisms considered objectionable, and the conclusion was reached that this test can replace the bacteriological test entirely. A table showing chlorine contents, bacterial counts, and other related data for the period October 28, 1926, to June 9, 1927, accompanies this report. Although no complete change of the water in the pool was made during the period covered, *Escherichia coli* was found only in three samples.

The germicidal properties of alkaline washing solutions, with special reference to the influence of hydroxyl-ion concentration, buffer index, and osmotic pressure, R. P. MYERS (*Jour. Agr. Research [U. S.], 38 (1929), No. 10, pp. 521–563, figs. 2*).—In this study at the New York Cornell Experiment Station, the germicidal properties of solutions of several commercial washing powders were tested. Special attention was given to the relation between the hydroxyl-ion concentration and germicidal efficiency.

It was found that powders which made solutions with a high pH value were more effective as germicides than those that made solutions with a low pH value, except in the case of powders containing chlorine. Solutions with a low pH value became more efficient germicides if the pH value was increased by the addition of sodium hydroxide. Diluting the solutions did not decrease their efficiency to the same degree, the decrease appearing to be closely correlated with the decrease in the hydroxyl-ion concentration of the solutions. A combination of high hydroxyl-ion concentration and high temperature was effective in destroying the spores of *Bacillus cereus* within a few minutes, while either factor alone was ineffective.

The influence of the pH, buffer index, and osmotic pressure of alkaline solutions on their germicidal action at 60° C. was studied, using spore suspensions prepared in 0.85 per cent sodium chloride solution, the vegetative forms being killed by exposure to heat and the spore suspensions then frozen to measure the germicidal action. An increase in the hydroxyl-ion concentration when the buffer index and osmotic pressure were kept constant increased the death rate. Likewise the death rate was increased when the buffer index was increased and the other factors kept constant, and when the osmotic pressure was increased with the other factors constant. Of these factors, osmotic pressure exerted the least influence. A solution of a high pH and a high buffer index at 60° was very effective for killing spores.

A neutral sodium hypochlorite solution was found to be more effective than an alkaline sodium hypochlorite solution when both solutions had the same amount of available chlorine. An alkaline hypochlorite solution with 0.01 per

cent concentration of available chlorine was equal in germicidal effectiveness to 0.25 normal sodium hydroxide. Osmotic pressure exerted no appreciable effect on the rate of hydrolysis of gelatin in strongly alkaline solutions, but the higher the buffer index and the higher the pH the greater was the rate of hydrolysis of the gelatin.

A titration method to determine the amount of alkali that is capable of maintaining a pH above 12 is proposed as a rapid method of determining the germicidal potency of alkaline washing solutions.

Effect of hydrogen ion concentration on the toxicity of sodium benzoate to microörganisms, W. V. Cruess and P. H. Richert (*Jour. Bact., 17 (1929), No. 5, pp. 363–371, figs. 4*).—The action of sodium benzoate in retarding the growth of *Saccharomyces ellipsoideus* was found in the experiments here reported from the University of California to be much more marked at pH values of from 2.5 to 4.5 than it was at from pH 5.0 to 9, the effect upon alcoholic fermentation by the yeast named running parallel with that upon multiplication.

The benzoate concentrations found necessary to prevent the growth of *S. ellipsoideus*, *S. cerevisiae*, a mucor mold, two penicillium molds, three strains of mycoderma yeast, a lactic acid bacterium, a vinegar bacterium, *Bacillus coli*, *B. subtilis*, and *B. sporogenes* varied widely with the pH value of the medium, much more benzoate having been required at pH values near neutrality than at values in the range 2.5 to 4.5.

It is noted that these observations have an important bearing on the preservation of such nonacid products as ripe olives, avocado pulp, and nonacid vegetables with sodium benzoate. Preliminary experiments have shown similar relations between effectiveness and pH value to hold good for certain preservatives other than sodium benzoate. *B. subtilis* was found distinctly less tolerant of acid and sodium benzoate than were *B. coli* and sporogenic forms.

On the technic of electrodialysis, especially of microelectrodialysis [trans. title], G. Ettisch and W. Ewig (*Biochem. Ztschr., 200 (1928), No. 1–6, pp. 250–257, figs. 2*).—Description is given of a cell for electrodialysis, the apparatus having been constructed for the most part from glass plates, the middle chamber from thee glass pieces of rectangular U shape, between the two outer and the thick inner pieces of which are clamped the dialytic membranes. The dimensions of the parts were chosen with reference to the current efficiency necessary to rapid removal of ions; and by an exchange, designed to be readily made, of pieces of different thickness between the membranes of the inner chamber the capacity of the last-named part of the apparatus can be varied from some 50 cc. to about 1 cc. Other factors concerned in the electrodialysis of, especially, sera are discussed.

A practical washing bottle for gas chain measurements and other purposes [trans. title], H. Schreus (*Biochem. Ztschr., 200 (1928), No. 1–6, p. 339, fig. 1*).—Noting that in arrangements of washing bottles one after another the changing of the solutions is always time consuming and can not always be performed as often as desirable by reason of the frequent necessity for long and continuous use of the gas, the author describes and illustrates a form of gas washing bottle or tube which possesses essentially the constructional features and advantages noted below.

The gas enters the washing vessel proper at the base, the inlet tube being bent twice at right angles to rise vertically and parallel with the axis of the main body of the washer and having blown upon it a bulb but little smaller than that forming the washing chamber to prevent the drawing back of the washing liquid through the inlet. The gas escapes from the top of the washing bulb through a small bulb or trap. The special feature of the

apparatus whereby refilling is greatly facilitated consists in the addition at the base of an outlet tube having a very short section directed vertically downward, followed by a bend to the horizontal and, as close as is conveniently possible to the main body of the vessel, a second right angle bend to the vertically upward direction, a 3-way stopcock carrying a suitable waste outlet, and a further vertical section attached by rubber tubing to a funnel which provides for the emptying, washing out, and refilling of the apparatus practically without interruption of the gas current. The 3-way stopcock is placed above the level of the liquid in the body of the vessel, the gas pressure being used to drive out the spent charge. The main bore of the stopcock having been set vertically, the washing chamber is refilled while its gas content escapes in the normal direction of flow, and a final setting of the 3-way cock (T-bored) at an angle closes off all movement of gas or liquid through or into the cock from all directions.

An iodometric micro method for the determination of chlorides [trans. title], S. Prikladowizky and A. Apollonow (*Biochem. Ztschr., 200 (1928), No. 1–6, pp. 135–144*).—The method described depends upon the principle stated first to have been used for the determination of chlorides by McLean and Van Slyke (E. S. R., 34, p. 507), the procedure having subsequently been modified by Van Slyke and Donleavy (E. S. R., 40, p. 714) and by Austin and Van Slyke (E. S. R., 45, p. 415). Essentially, the chlorine ion is precipitated as silver chloride by means of silver nitrate, the excess of silver nitrate is caused to react with potassium iodide in excess, and the excess of potassium iodide, on treatment with nitric and nitrous acids is converted into nitrate with the liberation of nitric oxide and free iodine, which last-named substance is titrated.

For the carrying out of the modification of this method as here described, the prescribed solutions are: (1) A N/100 solution of highly purified sodium chloride in twice distilled water; (2) a N/100 solution of silver nitrate, to be standardized not less frequently than once in 2 weeks against the N/100 sodium chloride solution; (3) a N/100 solution of iodine in aqueous potassium iodide (it is stated that reagents (2) and (3) must both be kept in dark glass bottles); (4) chloride-free nitric acid, diluted 1:3; (5) a saturated solution of potassium permanganate; (6) a glucose solution (concentration not specified); and (7) starch indicator solution.

In an Erlenmeyer flask of 25 to 35 cc. capacity place from 2 to 3 cc. of chloride-free distilled water and measure in 0.1 cc. of the sample from a microburette graduated to 0.001 cc. Then add 2.0 cc. (for a blood sample) or 1 cc. (for a plasma sample) of the diluted nitric acid, and 2 cc. of N/100 silver nitrate solution. Heat, preferably on a sand bath, to boiling. Add from 15 to 20 drops of the saturated permanganate solution and proceed with the boiling for from 10 to 12 minutes, during which time a dark color must persist in the solution. At the end of the boiling add the glucose solution drop by drop until the reaction mixture is decolorized, shaking the flask gently throughout the addition of the reducing agent. A perfectly clear solution should result. Filter through wetted cotton wool into another small Erlenmeyer flask, washing the first flask 3 times through the filter with 3-cc. portions of water, add to the combined filtrate and washings from 3 to 4 drops of starch indicator solution, and titrate the excess silver nitrate with a N/100 solution of iodine in aqueous potassium iodide from a microburette to the appearance of the starch-iodine blue color as end point.

Calculation of the result is illustrated by an example given in full detail.

The gravimetric method for the determination of carbonates in soil, N. A. Clark and E. R. Collins (*Soil Sci., 27 (1929), No. 5, pp. 407–414, figs. 2*).—

An improved method, a modification of the evolution and absorption procedures as previously employed, is described, and the special form of evolution apparatus and absorption train recommended are illustrated. Special features of the arrangement are the adaptation of a Brühl stirrer to the purpose of the continuous agitation of the soil acid mixture in the evolution flask, together with the use of dehydrite (magnesium perchlorate trihydrate) as a substitute for phosphorus pentoxide to dry the evolved gases and to trap moisture lost from the carbon dioxide absorbent, and the use of ascarite (asbestos with sodium hydroxide) as absorbent for the carbon dioxide.

The relative metrits of the three types of methods (titrimetric, gas volumetric, and gravimetric) in common use for the determination of carbon dioxide in soils are discussed briefly in connection with a short review of the published work and data presented in support of the claims of the new procedure to avoid the defects which have led to an unfavorable opinion of the gravimetric determination of soil carbonates are shown.

The precipitation of calcium oxalate in the presence of iron, aluminum, titanium, manganese, magnesium, and phosphates, with special reference to the determination of total soil calcium, H. D. Chapman (*Soil Sci., 26 (1928), No. 6, pp. 479–486*).—From the results of the investigation reported in this contribution from the Wisconsin Experiment Station the conclusion is drawn that it is possible to precipitate calcium oxalate completely and without contamination at pH 4.0 (as indicated by bromocresol green) in the presence of such quantities of iron, aluminum, titanium, manganese, magnesium, and phosphates as are encountered in the analysis of soils, soil extracts, and plant material. In condensed statement, the procedure prescribed is as follows:

Remove silica in the usual way. To the solution of calcium, magnesium, manganese, iron, aluminum, titanium, and phosphates add a quantity of ammonium chloride sufficient to insure the presence of at least 6 gm. of the soil. In the case of solutions acid with hydrochloric acid, calculate approximately the quantity of the acid present and adjust the quantity of ammonium chloride to be added to insure the presence after neutralization of the hydrochloric acid with ammonia of the quantity of ammonium chloride specified. Add further 1 gm. of oxalic acid in solution, together with 10 cc. of 1.76 N acetic acid and 10 drops of 0.04 per cent bromocresol green, bring the volume of the solution to from 150 to 200 cc. and heat nearly to the boiling point, adding slowly dilute ammonia sufficient to change the color from yellow through yellowish green to "the first pure green." Boil the solution gently for from 5 to 10 minutes, the calcium oxalate separating as a coarsely crystallized precipitate, then leave the mixture on a steam bath (at least 3 hours to insure complete precipitation) until the precipitate has entirely subsided.

"In determining calcium by titration with permanganate, the precipitate should be washed as few times as possible with distilled water, for calcium oxalate is slightly soluble. Using 9 cm. No. 589 S & S paper, it has been found for all ordinary amounts of calcium oxalate that rinsing the beaker three times, plus washing the precipitate five times, removes all excess oxalate."

This method is given as applicable for the determination of the total calcium content of soils, soil extracts, and plant tissue, and in other conditions where the quantities and proportions of the various elements noted above are "somewhat similar" to those occurring in the material used in the work here described.

Data illustrative of the close agreement obtainable as between the results yielded by the new method and those obtained by the older procedure involving the removal before the precipitation of the calcium and of the elements listed as noninterferent in the new procedure are given, together with figures

resulting from a study of the relation of the precipitation of calcium oxalate to the pH value of the reaction mixture as shown by various indicators.

On the oxidation of glucose and glycocoll by means of alkaline copper solutions [trans. title], H. LUNDIN (*Biochem. Ztschr.*, *207* (*1929*), *No. 1–3, pp. 91–106*).—The principal conclusions drawn from the work detailed in this paper are as follows:

Glycocoll was found to interfere, if present in sufficient quantity, with the oxidation of glucose by alkaline copper solutions containing carbonates. This was true, specifically, for solutions of the type represented by the reagents of Folin and Wu (E. S. R., 42, p. 712) and Folin (E. S. R., 55, p. 613) and in the range of alkalinity indicated by pH values of from 9.1 to 9.8.

It is noted that if the time of boiling be less than 10 minutes the interfering action of glycocoll is observable at even higher pH values. Solutions of pH value lower than 9.1 were not investigated, but it was observed within the range above stated that the interference was greater in proportion as the pH value was lowered, the time of boiling and the concentrations of glycocoll and glucose remaining constant. An increase in time of boiling tended to lessen the interference. When the reduction was effected by a solution containing both glucose and glycocoll and at a pH value such that glycocoll did not show its interfering effect (pH 9.8 or higher), the total reduction was found approximately to equal that to be expected as the sum of the individual reductions of the quantities of glucose and of glycocoll taken separately, except under conditions of excessive alkalinity.

The oxidation of glycocoll by alkaline copper solutions containing carbonate increased rapidly with increasing pH value or time of boiling. The pH value being held constant, the extent of the oxidation was dependent upon the carbonate content of the reagent, the lower carbonate contents yielding the lower oxidation values.

The optimum alkalinity for the oxidation of glucose by alkaline copper solutions containing carbonate was found to be represented by the approximate pH range 9.2 to 9.8. To insure reproducible results it was found necessary, in working with sugar solutions of appreciable buffer capacity, to add to the sugar solution sodium hydroxide sufficient to bring it to a pH value the same as that of the alkaline copper reagent.

It is noted that the pH values given are approximate only and relate to the H-ion concentration of the reaction mixture before the heating.

On the oxidation of glucose and glycocoll by means of alkaline copper solutions in the presence of boric acid [trans. title], H. LUNDIN (*Biochem. Ztschr.*, *207* (*1929*), *No. 1–3, pp. 107–119*).—Boric acid was found to interfere with the oxidation of glucose by alkaline copper solutions of the types noted above, this action having been investigated especially in the approximate pH range 9.1 to 10.5. The interfering action of boric acid was, within the pH range stated, increased proportionally as the pH value was diminished, the time of boiling and concentrations of glucose and boric acid remaining constant. When the proportion of boric acid to glucose was made very large (from 400 to 500 to 1), the glucose was not oxidized at all in the pH range specified and in a heating period of from 6 to 7 minutes. Increasing the time of heating tended to lessen the interfering action, however.

A copper reagent containing borates, such as that of Folin and Wu, oxidized amino acids, creatinine, and some other substances practically to the same extent as did the usual nonboratic reagents of practically the same pH value and carbonate content. It is said to be possible to prepare a boratic alkaline copper solution of a pH value approximately the same as that of the Folin-Wu reagent, yet almost incapable of reduction by small quantities of glucose,

although reduced to the same extent by glycocoll, creatinine, and the like, as was the Folin-Wu solution. This reagent contains 56 gm. of boric acid, or 85 gm. of borax, in a liter. When solutions containing glycocoll up to 8 gm. in a liter, or creatinine up to 0.5 gm. in a liter, together with glucose in concentrations up to 0.2 gm. in a liter, were oxidized both with the Folin-Wu reagent and with the above noted boratic solution, the difference between the two values was found to represent the quantity of glucose present.

A specific color reaction for ergosterol, O. ROSENHEIM (*Biochem. Jour., 23 (1929), No. 1, pp. 47–53, fig. 1*).—Both chloral hydrate and trichloroacetic acid have been found to give with ergosterol of the highest purity a characteristic blue color reaction, while all of the other naturally occurring sterols which have been tested remain colorless under the same conditions. The technic for conducting the test is described and the mechanism of the reaction is discussed.

METEOROLOGY

The past cold winter and the possibility of long-range weather forecasting, W. J. PETTERSSON (*Nature [London], 123 (1929), No. 3108, p. 796*).—Attention is called to the low percentage of success in attempts to predict the weather for more than a week ahead. It is stated that "one reason for this failure is to be found in the refusal of the modern meteorologist adequately to take into account in the problem of weather prediction of direct terrestrial influences, such as that of the physical state of the surface waters of the oceans. . . . Another reason is his neglect of the 'polar front' theory of Prof. Bjerknes." An attempt is made to connect the past severe winter in Europe with "some modification of the normal temperature of the seas within the area of exceptional cold." A plea is made for a systematic international study of the physical states of all of the seas and oceans in and around Europe as a basis for long-period weather forecasting.

Climatological data for the United States by sections, [January–February, 1929] (*U. S. Dept. Agr., Weather Bur. Climat. Data, 16 (1929), Nos. 1, pp. [201], pls. 3, figs. 2; 2, pp. [203], pls. 3, figs. 2*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for January and February, 1929.

Meteorological tables, D. A. SEELEY (*Mich. State Bd. Agr. Ann. Rpt. Sec., 66 (1927), pp. 135–147*).—Daily and monthly summaries of temperature, precipitation, cloudiness, and sunshine, and monthly summaries of pressure, wind movement, and miscellaneous phenomena (frost, hail, thunderstorms, fog, auroras, and halos), at Lansing, Mich., are given for the year ended June 30, 1927.

The weather in Ohio during the year 1927, W. H. ALEXANDER and C. A. PATTON (*Ohio Sta. Bul. 431 (1929), pp. 168–179, figs. 3*).—Data for temperature and precipitation are summarized for the experiment station at Wooster and for the State as a whole. Evaporation and length of the frost-free period at the station are also recorded.

It is stated that the year was "largely free from severe extremes and climatic disasters." Precipitation was excessive for the year as a whole, but snowfall was only about three-fifths of the normal, the average for the State being 18.1 in.

Climatic and agricultural relations in Russia [trans. title], W. v. POLETIKA (*Kulturtechniker, 31 (1928), No. 6, pp. 507–519*).—The predominating influence of climate in Russian agriculture is especially emphasized in this article. It is stated that about one-fourth of the area of European Russia is not suited

to agriculture of any kind and that about two-thirds of the remaining area is subject to climatic extremes and deficiencies which greatly handicap agriculture. The climate is continental in character. Among the climatic handicaps enumerated are sharp changes of temperature from summer to winter and from day to night; long and severe winters, especially in eastern Siberia, and hot summers in the south; lack of snow cover in Siberia and occurrence of perpetually frozen soils; deficiency of precipitation in the south and southeast; unfavorable rainfall distribution in the spring and early summer; short growing period; and droughts, hot winds, and frosts. The need and means of overcoming these handicaps are indicated.

SOILS—FERTILIZERS

[Chemical and physical studies of soils] (*Ohio Sta. Bul. 431 (1929), pp. 30–32*).—A study of the effects upon the physical properties of soils produced by their saturation with calcium, potassium, magnesium, manganese, and sodium ions by leaching with the corresponding normal acetate solutions and with the hydrogen ion by leaching with N/10 hydrochloric acid, followed by measurements of the moisture equivalent, hygroscopic coefficient, heat of wetting, state of flocculation, rate of slaking, and the Atterberg plasticity constants, showed that the various cations, with the exception of sodium (which caused a large increase), were without effect on the moisture equivalent. Saturation of the soil with the potassium ion decreased the heat of wetting and the hygroscopic coefficient, other cations having little effect upon these properties. Both the potassium and the sodium ions deflocculated the soil. The soil saturated with the manganese ion immediately formed a flocculent and curdy condition when suspended and "settled as a continuous column."

"The values for the Atterberg consistency constants were changed very greatly in some cases, as a result of saturation of the soil with the various cations. The divalent cations tended to increase the plasticity number, by either lowering the lower plastic limit, raising the upper plastic limit, or both. Sodium lowered both limits, at the same time increasing the plasticity number." This work is attributed to L. D. Baver.

As the result of a study of the relation between exchangeable calcium and magnesium to the reaction and inorganic content of soil in a number of soil profiles it was found that a very good correlation could be demonstrated in most cases between the degree of saturation (defined as the sum of the exchangeable bases divided by the total absorptive capacity) and the pH value of the soil. In the cases of soils containing carbonates, however, a satisfactory correction for the dissolved carbonate could not be made. "Exchange calcium followed very closely the reaction of the soil, exchange magnesium reached a maximum just above the calcareous substratum. The pH value seemed to give a good indication as to the degree of saturation. This, with a determination of the absorptive capacity of the soil, should give a good picture of the acidity relationships of the soil." This study is credited to T. C. Green.

Work on the variation in the colloids of Ohio soil profiles, including determinations made by the Robinson sedimentation procedure, by water absorption, by measurement of the heat of wetting, and by means of the hydrometer (E. S. R., 59, p. 809) indicated a fairly close correlation between the Robinson, water absorption, and heat-of-wetting procedures except in the case of soils of high organic matter content, for which last-named material the sedimentation process gave a value lower than those obtained by the other methods. The hydrometer method was found to check fairly well with the other methods in

the case of soils of high clay content, but with silt loams the hydrometer method yielded results much higher than those of the other methods. This work is indicated as having been carried out by J. G. Steele.

An investigation of soil consistency, including measurements of the Atterberg consistency constants (upper and lower plastic limits and plasticity numbers) in several profiles indicated that organic matter tended to raise the values of the upper and lower plasticity limits without in every case increasing the plasticity number over that of soil horizons having similar texture but lower contents of organic matter. In heavy upper subsoil plastic layers, for which the plasticity numbers were high, the increase observed was mainly in the upper plasticity limit. A much lower plasticity number was commonly observed in the lower than in the upper subsoil. This section of the report is based upon a study conducted by A. H. Paschall.

The drift in potential of the quinhydrone electrode formed the subject of a study carried out by Baver, leading to the conclusion, among others, that the calomel half cell is preferable to those made up with N/20 potassium hydrogen phthalate or with a mixture 0.01 N with respect to hydrochloric acid and 0.09 N with reference to potassium chloride, the calomel being considered the more stable half cell. A number of other methodic details of importance for accurate results are noted.

E. E. Barnes is credited with an investigation of the size-frequency of silt and clay fractions of soils in which the customary method was found adapted to suspensions of materials which do not take up water of hydration, whereas hydrophilic clays gave abnormal results. Some other similar points brought out by the study are briefly mentioned.

Report of the section of soils (*Michigan Sta. Rpt. 1927 pp. 366–369*).—In studies by C. H. Spurway, a tendency was noted for water-soluble phosphorus to rise to the surface of the soil. Soils showing less than 0.5 p. p. m. of phosphorus in the soil extract are believed likely to respond to phosphorus fertilization, while soils that have from 3 to 4 p. p. m. respond very little if at all.

Plants accumulate comparatively large amounts of phosphorus and potassium in their cell sap when they are grown on soils treated with fertilizers carrying these elements. Phosphorus and potassium tend, however, to decrease in amount in the cell sap as the plants approach maturity.

The row method of application of lime or the use of it in small quantities along with sweetclover and alfalfa seed again seemed promising. Investigations on the seed production of alfalfa indicate that seed yields are not in proportion to vegetative growth, and fertilization may decrease the yield if there is too great vegetative stimulation.

In studies on the effect of Anaconda phosphate on the germination and early growth of beans, C. E. Millar found that as small quantities as 10 lbs. per acre were seriously injurious if applied in direct contact with the seed. If kept away from the seed, much larger quantities may be used without injury.

Daily and seasonal air and soil temperatures at Davis, California, A. SMITH (*Hilgardia [California Sta.], 4 (1929), No. 3, pp. 77–112, figs. 57*).—A knowledge of the range of temperature at various depths in the soil was sought as helpful in the interpretation of bacterial activity.

The moisture content of the surface 3 ft. of a loam of the Yolo series was found to be from 20 to 22 per cent following a seasonal rainfall amounting to about 3 in. A fine sandy loam subsoil had under the same conditions a moisture content of from 16 to 18 per cent. The moisture equivalent of the loam was determined as about 20, while for fine sandy loam subsoil it was 16. No crops

had been grown on the area in question since 1923, and weed growth had been prevented by monthly cultivation. It was observed that changes in moisture content were due almost entirely to vapor movement. Under an unperforated black paper mulch the moisture content of the surface 4 in. of the soil was about 20 per cent. At various depths below the surface 4 in. the moisture contents during the dry season were found practically the same as were those of a cultivated area not covered with the paper mulch.

Temperature variations were also recorded in similar detail, and the significance of the results attained is discussed briefly.

"The range in the air temperatures during the 1925 period was 86°, while at a depth of 0.5 in. the soil temperature range was 114°. The range for the deeper soil areas was progressively smaller, so that at the 36-in. depth it was the least, or 31°. . . .

"The range in air temperatures during the 1927 period was 81° while at a depth of 0.5 in. it was 76°. The lowest air temperature recorded was 24° while the lowest soil temperature at the 0.5-in. depth was 32°—or 8° higher. The range for the deeper soil layers was progressively smaller, so that at the 36-in. depth it was only 24° during this period. . . .

"The time of the occurrence of the maximum and minimum soil temperatures as compared to the maximum and minimum air temperatures, or the lag, varies from less than one hour at the 0.5-in. depth to approximately 80 hours at the 36-in. depth.

"The effect of the daily distribution of the rainfall on the soil temperatures is very marked, and during years when the monthly rainfall is recorded as being above normal, the soil temperatures during that month may show a very distinct rise and fall on account of the fact that the rainfall may have been confined to a very short period.

"The various parts of plants growing in the field, such as the leaves, stems, and roots, are subjected to widely different temperature conditions. On July 17, 1925, the leaves and branches were in air heated to 116°; the stem (unshaded) just below the ground surface was in soil having a temperature of 143°; while the roots were in a medium with a temperature of 107° at the 3-in. depth to 84° at the 24-inch. depth."

The influence of substituted cations on the properties of soil colloids, M. S. Anderson (*Jour. Agr. Research* [*U. S.*], *38* (*1929*), *No. 10*, *pp. 565–584*).—This paper deals with the changes brought about by the substitution of various cations for the exchangeable bases in the soil colloids, and is contributed from the U. S. D. A. Bureau of Chemistry and Soils.

Determinations were made of the heat of wetting, the water vapor adsorption, the swelling, and the moisture equivalent, and measurements were made of the cataphoresis and of the pH values of seven widely different colloidal materials as affected by saturation with calcium, magnesium, potassium, sodium, and hydrogen ions, and with the cation of methylene blue. The cations named affected the heat of wetting and the moisture adsorption in the decreasing order, calcium, magnesium, sodium, hydrogen, potassium, and methylene blue. On the other properties mentioned the decreasing order of effect was approximately sodium, potassium, calcium, magnesium, hydrogen, and methlyene blue. The varying effects of the different cations are ascribed as differences in solubility and dissociation tendency of the colloid cation combinations and to consequent differences in the density and diffusivity of the Helmholtz double layer of the colloidal micelles. "The influence of a cation on a property seems to be in direct proportion to its percentage of complete replacement, but the data do not indicate this with certainty."

The various soil colloid materials studied were found to vary widely in the degree to which they were subjected to alteration in properties, some having been markedly altered whereas others were not appreciably affected by the substitution of any cation. The extent of the alteration of properties was found to correlate fairly well with the magnitudes of the properties of the untreated or calcium saturated materials, with the total content of exchangeable bases and with the ratio silica: the sum of the aluminum oxide and iron oxide of the colloid in question. These correlations are considered explicable on the ground that many properties of soil colloids are influenced directly by the total content of exchangeable bases, while the exchangeable base content depends in some measure on the silica: aluminum oxide plus iron oxide ratio.

"It is pointed out that range of alteration of the colloidal soil material should be considered in judging what soils would show appreciable changes in properties following heavy applications of a single fertilizing salt. Range of alteration should also prove valuable in indicating those alkali soils that will become impenetrable on leaching. Probably in the case of most soil colloids, except those of saline soils, the properties in general will be indicated as accurately as can be expected simply by the total base-exchange capacity or by one of those determinations correlated with it, such as

$$\frac{SiO_2}{Al_2O_3+Fe_2O_3}$$

ratio, specific absorption capacity, specific heat of wetting, etc. These determinations, except that of the silica ratio, will indicate the kind of colloid even when applied to the whole soil, if the quantity of clay or colloid is known."

A study of the physicochemical aspects of soil acidity, C. S. Robinson (*Michigan Sta. Rpt. 1927, p. 336*).—A study of the buffer action of acid soils and of the basic principles of a number of methods for the determination of soil acidity has thus far indicated that neither the sugar inversion method nor the Jones test measures the actual total acidity of the acid soils examined.

Changes in the nitrate and sulfate content of the soil solution under orchard conditions, E. L. Proebsting (*Hilgardia [California Sta.], 4 (1929), No. 2, pp. 57–76, figs. 4*).—In contrast to the results of Burd and Martin (E. S. R., 52, p. 418), who observed a marked drop in nitrate content at the end of the growing season in the case of cereals, the author of the present contribution from the Davis Substation showed that in the case of orchard trees the nitrate content of the soil solution tended to rise during the growing season. It appeared that, with the exception of the alfalfa cover, nitrification exceeded utilization throughout the summer months. The minimum observed in the spring is attributed tentatively to a withdrawal of nitrates by the roots developing at that time.

There was observed in the case of these orchard soils a phenomenon described as similar to the appearance previously noted by Burd (E. S. R., 55, p. 212) of a high sulfate content in soils depleted with respect to their content of chloride and nitrate ions, a comparison of the series of soils under peaches with that under pears having shown in the peach plats a higher sulfate content and lower nitrate content than were found in the pear plats. The coefficient of the correlation between the concentrations of these ions was found very low, however, and the seasonal fluctuations of the two ions showed no reciprocal relationship.

"It is possible that the bicarbonate relationship may offer at least a partial explanation of these discrepancies, though adequate data on this point are not available at the present time. The fact that nitrates are generally somewhat

higher and sulfates lower than in most of the cropped soils reported on by Burd and Martin suggests that with more intensive cropping the differences between species noted here might be more striking, and certain anomalies in the figures might disappear."

Certain relations of the work here noted to previous work by the same authors on water displacement of the soil solution (E. S. R., 54, p. 15) are pointed out.

[**Soil Survey Reports, 1923 Series**] (*U. S. Dept. Agr., Bur. Chem. and Soils* [*Soil Survey Rpts.*], *Ser. 1923, Nos. 13, pp. 357–399, fig. 1, map 1; 37, pp. 1203–1222, fig. 1, map 1; 39, pp. 1267–1313, fig. 1, map 1*).—Of the 1923 series, three surveys are here noted.

No. 13. *Soil survey of Greene County, Alabama*, J. F. Stroud.—Greene County consists of 412,800 acres of Gulf Coastal Plain lands situated in west-central Alabama and of a topography varying from "very broken and hilly" to a rather flat area well drained only on its low ridges and but fairly to poorly drained in its swales and swampy part. The farm lands are said to be connected either with streams or with intermittent branches.

The agricultural soils of this area are here classified as Ruston fine sandy loam, 15.1 per cent of the surface surveyed, and 23 other types grouped into a total of 15 series. Unclassifiable meadow material, covered with water or wet during the greater part of the year, was found to the extent of 2.7 per cent.

The survey was made in cooperation with the Alabama Department of Agriculture and Industries.

No. 37. *Soil survey of Livingston County, Michigan*, L. C. Wheeting and S. G. Bergquist.—Livingston County, in the south-central part of the Michigan Lower Peninsula, comprises an area of 363,520 acres of the glaciated region, and has the topographic features of till plains, terminal moraines, and outwash plains. The soils are grouped as well drained, of intermediate character in this respect, and poorly drained.

Miami loam 40.7 per cent of the total area of the county, Carlisle muck 14.4 per cent, and Bellefontaine sandy loam 11.9 per cent are the most extensive among the 16 soil types representative of 14 series found in the present survey of Livingston County.

This survey was made in cooperation with the Michigan Experiment Station.

No. 39. *Soil survey of Berkshire County, Massachusetts*, W. J. Latimer and M. O. Lanphear.—Berkshire County extends across the western end of the State, possessing an area of 603,520 acres. The county has the main physiographic divisions of (1) a broad, deeply dissected plateau in the eastern part, (2) a broad lowland, running north and south across the western side of the county, and (3) the Taconic Range of mountains terminating in the Mount Everett Range at the southern end of the county. Both drainage and the water supply are good, the Connecticut River and the Housatonic and Hoosic Rivers being included among the main drainage outlets.

A total of 32 soil types classified as 22 series were found in the survey here reported, among which types Becket loam leads in areal extent with 10.7 per cent of the county surface. Areas not classified in the present survey include the rough stony lands to an extent of 34 per cent of the entire area, together with small areas of muck soils and meadow lands.

This survey was made in cooperation with the Massachusetts Department of Agriculture.

Soil Survey of Iowa—Plymouth County, W. H. Stevenson, P. E. Brown, et al. (*Iowa Sta. Soil Survey Rpt. 54* (*1929*), *pp. 62, pls. 2, figs. 11*).—Plymouth County, in northwestern Iowa, comprises an area of 550,400 acres of soils having mainly a loessial origin and a variable topography, and possessing a drainage system "quite adequately developed."

In the soil survey of Plymouth County 14 individual soil types were found, of which 85.5 per cent were loess soils. Marshall silt loam covers 81.3 per cent of the total area of the county.

In addition to the soil survey, data are presented on the results of various experiments and soil fertility tests, together with suggetions in regard to the control of such erosion as is met with in the county.

Soil survey of the Valier irrigation project, W. DeYoung (*Montana Sta. Bul. 217 (1928), pp. 40, figs. 3, maps 2*).—The Valier irrigation project of Montana, included entirely within Pondera County, possesses an area of about 160,000 acres, and has topographic features comprising nearly level or gently undulating lands and, bordering certain of the creeks, broken and rolling lands.

The survey here reported established the presence of 11 series of soils inclusive of 25 types, together with less important areas of overflow bottoms, rough broken land, seeped alkali areas, and coulee material. The percentages of the total area of the project occupied by the various types found are not stated in the report, but are indicated in an accompanying map.

Soil survey of Garden County, Nebraska, L. A. Wolfanger et al. (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.], Ser. 1924, No. 17, pp. 55, fig. 1, maps 2*).—Garden County, west-central Nebraska, is situated in the eastern part of the Nebraska "panhandle" and extends over an area amounting to 1,079,680 acres. The topographic features of Garden County, originating in the reduction of a former broad plain, include remnants of the original plateau, in part covered by loess deposits, narrow alluvial bands, and sand deposit areas, together with a drainage system including both the North Platte River and tributaries.

The 32 soil types mapped and described in Garden County are here presented as 14 series, together with dune sand, river wash, and rough broken lands, not classified. Dune sand occupied 51.9 per cent of the area, with Valentine sand and loamy sand next in extent with 6.9 and 5.9 per cent, respectively.

The survey was made in cooperation with the University of Nebraska.

Soils of Willamette series and their utilization, W. L. Powers, C. V. Ruzek, and R. E. Stephenson (*Oregon Sta. Bul. 240 (1928), pp. 28, figs. 5*).—The Willamette series is described as consisting of gently rolling, naturally drained, brown colored lands of the valley floor of the Willamette, the total acreage amounting to about one-third of a million. It is noted that four types of the Willamette series have been mapped, namely, Willamette loam, silt loam, clay loam, and silty clay loam, the average texture having been found to be that of a silt loam having an organic content approximating 5 per cent.

Analyses indicate an adequate supply of such essentials as phosphorus and potassium. A marked variation in calcium content, considered partly to account for differences reported in lime response in various fields, was noted in the analyses. In certain of the soils the exchangeable calcium supply was relatively large.

"Crop rotation has given remarkable results in experiments maintained on Willamette silt loam for the past 15 years, with increase in average yields up to 65 per cent where accompanied by good farm practice. . . .

"Fertilizer experiments maintained the past 15 years show only moderate returns. This is owing partly to the good state of fertility of all plats as a result of using a good crop rotation and partly to the fact that dry summers tend to mask the results or cause lack of moisture to be the first limiting factor.

"Moderate increases in yield have been received from farm manure, lime, potassium sulfate, sulfur, and complete fertilizer, results varying somewhat according to kind of crop.

"In a new experiment under way the past 6 years lime and manure, and lime, manure, and superphosphate have given largest yields of clover and corn.

"Cooperative fertilizer trials indicate that fertilizers are more helpful on the lighter types and older cropped lands of the Willamette series in the lower part of the Willamette Valley. Potassium with some nitrate seems to increase the length, strength, and percentage of fiber in flax when grown on soils of the Willamette series. Effectiveness of fertilizers depends on drainage, moisture, tilth, supply of organic matter, liming on acid soils, presence of beneficial bacteria, and the season.

"Eight years' results from a study of rates, forms, combinations, and manner of use of barnyard manure indicate that superphosphate is effective for reinforcing manure and that better returns are realized from phosphates or lime when used in conjunction with barnyard manure. A 20-ton application appears to be an economic rate and it is most effective if disked in and plowed under. Benefit from manure applied once was reflected in the eighth crop. Straw applied in the fall has given good returns. Nitrogenous material used with grain straw hastens its decay and aids effectiveness.

"Supplemental irrigation has strikingly increased yields of staple crops, and it is especially profitable where obtainable at reasonable cost when used with late-season crops or intensive cultivated crops. Crop rotation and manuring have doubled the yield, trebled returns on acre-inch irrigation, and reduced the water cost by half."

Meaning and use of Willamette soil survey, E. F. Torgerson and W. L. Powers (*Oregon Sta. Circ. 90 (1928), pp. 19, figs. 4*).—Among the subjects discussed are the value of soil surveys; soil development; the soil profile; soil horizons; soil groups, series, classes, and types; the naming of soils; the approximate areas of Willamette Valley soils; soil survey field methods; the use of the soil map; the soil report and its use; the use of analytical data and the data from experiment station soil plats; and the examination and judging of soils in the field.

The bulletin contains also a key to the Willamette Valley soils, recommendations for the utilization of these lands, and an appendix in which are taken up the subjects of the identification of soils from samples collected in the field, the judging of the texture of soils, and the procedure suitable for soil sampling. The appendix contains also a statement of the type of information which must accompany soil samples.

Crop yields from Illinois soil experiment fields in 1928, F. C. Bauer (*Illinois Sta. Bul. 327 (1929), pp. 209–238, fig. 1*).—This bulletin continues a series of reports on soil fertility tests on Illinois soil experiment fields, last represented by Bulletin 305 (E. S. R., 59, p. 318).

Effect of soil treatment at Germantown, C. E. Thorne (*Ohio Sta. Bimo. Bul. 138 (1929), pp. 67–74*).—Under the two subheads of the tobacco rotation and the cereal rotation, soil and fertility tests and rotation work, for the most part of the usual type, are reported in some detail with many of the numerical data accumulated.

AGRICULTURAL BOTANY

[Report of the work in plant physiology], R. P. Hibbard (*Michigan Sta. Rpt. 1927, pp. 332–335*).—In studies on the effect of climatic and environmental factors on the growth of plants, where light was controlled top growth of wheat in water cultures was normal, but root development was not abundant. The continuous illumination of the plants with 300 foot candles was considered to be insufficient to produce enough photosynthate to permit of good root growth.

Increasing the light intensity to 800 foot candles caused too high a temperature, and the young wheat plants were killed in 12 hours. Older plants, well established in water cultures, remained green but did not make good growth. Where the temperatures were not too high an increase in illumination for a long period of time resulted in more succulent growth than in plants under normal sunlight.

The progressive seasonal changes of carbohydrates, fats, and proteins in potato, soybean, and sunflower plants were studied by H. F. Clements. Nitrogen was found to increase in the leaves of all three plants until flowering, after which it decreased. The action of carbohydrates was just the reverse. Fats were found to vary directly with the carbohydrates. In studying the diurnal variations in carbohydrates, evidence was secured to indicate that sucrose is not the first sugar formed; that starch is present because translocation is not rapid enough; that hemicelluloses are reserve materials during the day; and that the greatest translocation of materials occurs between 1 and 3 o'clock in the afternoon. A study of the physiological balance with the garden pea is said to have shown that solutions which afford the best growth in one season may not be the best during another season.

Wide spacing and abundant water were found to cause excessive tuber growth of potatoes, resulting in more growth cracks and hollow tubers than where close spacing and reduced water supplies were provided.

The use of ethylene gas for artificial ripening was tested, and the change in color of celery, oranges, bananas, tomatoes, and apples was found to be due to the destruction of the chlorophyll. The use of this gas to produce blanching in celery is not recommended. For the others it is considered commercially profitable.

Tests were made of paper and glass frost protectors, but due to unfavorable soil and climatic conditions the results were not conclusive. In one series tomato plants escaped frost injury, but at the end of a month's growth in the field there was no visual difference in the size of the covered and uncovered plants.

The influence of light relations on the development of root systems [trans title], N. A. Maximow and E. Lebedincev (*Ber. Deut. Bot. Gesell., 41 (1923), No. 7, pp. 292–297*).—The authors point out that even if light can not be shown to exert an immediate influence on the development of the underground part of the plant, the root system clearly reacts to differences and changes in the light relations of the above ground parts. Plants cultivated in full sunlight develop a significantly larger root system than do plants grown in the shade. The stimulating effect of light on the development of the root system is clearly altered after the removal of growing plants from shade to sunlight. The stimulatory effect of light shows itself clearly in the development of the water-conducting elements, and this phenomenon is thought to be connected with the elevation of temperature in light.

Physiological and anatomical peculiarities of plants grown in dry or in moist air [trans. title], E. Lebedincev (*Ber. Deut. Bot. Gesell., 45 (1927), No. 2, pp. 83–96, figs. 2*).—These studies, following up those above noted and particularizing the physiology and developmental behavior of *Phaseolus vulgaris*, *Soja hispida*, and *Amaranthus retroflexus* under controlled conditions, are said to have shown the dry weight product in plants grown in moist air to be greater than that produced under dry air conditions. Both water content and guard cell behavior may be significant in this connection. The water requirement was greater in dry air. The behavior of different plants is discussed. The dry air plants showed such xerophytic characters as smaller cells, more stomata per unit area, and denser veining. The damp air plants transpired more readily in response to external factors.

Transpiration intensity in plants [trans. title], W. G. ALEXANDROV (*Ber. Deut. Bot. Gesell.*, *45* (*1927*), *No. 2*, *pp. 67–82*).—Tests with mesophytes, under conditions which are particularized, showed that not under all conditions do xerophytes present greater capability for transpiration than do plants of the other ecological types. In the shading experiments the xerophytes transpired more than did the mesophytes. Plants which develop in early spring behave much as do those which grow chiefly in late summer. Plants having xerophytic structure show in midsummer, under conditions of southern continental climates, a greater capacity for transpiration than do mesophytes.

Intensity of transpiration is the result of very complicated correlations in the life of a plant organism, as water and light supply during its cultivation, but the combination of meteorological conditions during growth and just previous to the experiments also plays a part. In accordance with the character of the developmental history of the plant, the combination of experimental conditions gives the reaction in the living plant organism which becomes apparent in the degree of intensity of transpiration.

Stomatal aperture in wilting leaves [trans. title], F. WEBER (*Ber. Deut. Bot. Gesell.*, *45* (*1927*), *No. 6*, *pp. 408–412*).—In leaves of many herbaceous plants beginning to wilt under natural conditions in direct sunlight the stomata open to their extreme width and remain open. If such leaves are now infiltrated with water, the stomata quickly close, but after infiltration with an 8 per cent cane sugar solution, the stomata remain open for some time. It is concluded that the extremely wide opening of the stomata in wilting leaves is due primarily to loss of turgor of the epidermal cells; the closure of the stomata on or after such subsequent water infiltration of the fully turgescing epidermal cells to the pressure exerted on the guard cells.

The use of cellophane to determine stomatal aperture [trans. title], F. WEBER (*Ber. Deut. Bot. Gesell.*, *45* (*1927*), *No. 8*, *pp. 534, 535*).—Cellophane, a light, thin, transparent, flexible paper of fiberless, pore-free cellulose obtainable in colored or colorless sheets, is so hygroscopic that when laid on a very slightly moist or transpiring surface it shows very sensitively the degree of moisture absorption. This property fits the material for use in determining the degree of aperture of leaf stomata in experimentation of the kind referred to in the account above noted.

Plasticity of leaves and the xeromorphic structure [trans. title], W. G. ALEXANDROV (*Bot. Arch.*, *18* (*1927*), *No. 4*, *pp. 282–287*; *Eng. abs.*, *p. 287*).—This work takes into account both qualitative and quantitative differences and variations in leaf structure and gives an account of studies dealing chiefly with two plants classed as mesophytes, *Helianthus annuus*, the leaves of which may vary from mesomorphic to xeromorphic, and *Datura stramonium*, the leaves of which are always mesomorphic.

Especially plastic are those leaves which readily change as regards the number and character of the anatomical elements and as regards the character of the cell conjunction, which is dependent on the conditions. It is thought that the primitive form of the sunflower was probably xerophytic, that of the thorn apple mesophytic. Changes in structural details, with age and conditions, are outlined.

Though smallness of the structural units has sometimes been linked with xeromorphy, observations are considered to show that the structure involving small cells is not the typical expression of xeromorphy, though it may constitute the first stage of development of that habit. It is claimed that the really xeromorphic structure of leaves expresses itself in the origination of isolaterality and in the formation of water cells. To this, it is stated, may be added decrease of intercellular dimensions in relation to cell dimensions.

The effect of freezing on the catalase activity of apple fruits, D. B. Carrick (*New York Cornell Sta. Mem. 122 (1929), pp. 18, fig. 1*).—In a previous publication the author showed that the evolution of carbon dioxide from mature apple fruits was affected when the tissue was frozen (E. S. R., 59, p. 215). Investigations were made subsequently to determine the catalase response of variously frozen apples.

It was found that extreme freezing of the McIntosh apple, in which most, if not all, of the cells were killed, markedly reduced the catalase activity, this effect coinciding with the corresponding response of carbon dioxide evolution. It is believed that the enzyme catalase is partly destroyed by freezing, along with the other cell contents.

The vascular tissue of the McIntosh apple gave an increased catalase activity when tested immediately after 3, 6, and 9 hours' freezing at an air temperature of −7.5° C. The vascular tissue was found to have a greater catalase activity than the parenchyma. However, in both tissues catalase was greatly reduced after 20 hours' freezing.

The catalase measurements on the vascular tissue of Baldwin fruits were generally unsatisfactory. Immediately after freezing, the 6 and 24 hour treatments, and possibly the 9-hour exposure, showed a slight gain in catalase activity, while the 3-hour exposure gave results similar to those in the normal fruit. Three days after freezing, the 6 and 9 hour freezing induced a slight increase of catalase activity in Baldwin fruits, while apples frozen for 3 and 24 hours did not differ from the control. Seven days after freezing, the Baldwin fruits in the 3 and 6 hour treatments gained slightly in catalase activity, while in the tissue frozen for 9 hours it was somewhat retarded. In fruits frozen for 12 and 24 hours the results were similar to those in the control experiments.

Carbon dioxide manuring [trans. title], H. Fischer (*Ber. Deut. Bot. Gesell., 45 (1927), No. 6, pp. 331–339*).—The author gives a review of the subject of carbon dioxide manuring and a statement regarding its apparent possibilities. Some of his related contributions have been noted (E. S. R., 55, pp. 518, 519).

Electric stimulation of plant growth, G. N. Collins, L. H. Flint, and J. W. McLane (*Jour. Agr. Research [U. S.], 38 (1929), No. 11, pp. 585–600, figs. 5*).—Following the report of Sir Oliver Lodge on the effect of electricity on plant growth (E. S. R., 20, p. 630), field experiments were conducted by Briggs et al., which have been noted (E. S. R., 54, p. 731). After Blackman published the results of his laboratory work (E. S. R., 38, p. 525), the authors undertook electroculture experiments under controlled conditions in which seedlings of maize and barley were subjected during their early period of development to conditions of modified atmospheric electrical gradient. Difficulty was experienced in providing a uniform environment that would eliminate significant differences in the rate of growth cultures given the same treatment. This is said to have shown that in many instances the association between treatment and a changed rate of growth was not in the nature of cause and effect, and to indicate that in experiments of this nature caution should be exercised in accepting conclusions based on the statistical significance of one type of experiment.

By exercising great care in the preparation and planting, 4 experiments were conducted in which two of the boxes containing the plants were subjected to a charge from the overhead network that induced a total discharge equal to 10^{-8} amperes per plant. In none of these experiments was there a measurable difference between treated and control in either weight or elongation. An analysis was made of 8 of the most satisfactory experiments, in which the plants were sorted according to their initial size, and when comparisons were made of

the elongation of treated and control plants of the same initial height, no significant differences were observed.

To test further the possibility of a detrimental effect of excessive currents, an experiment was undertaken with the maximum current possible without sparking. Even this excessive current did not produce any significant change in the rate of growth.

Promotion of plant growth by means of electricity [trans. title], M. KOERNICKE (*Ber. Deut. Bot. Gesell., 45 (1927), No. 4, pp. 245–250, fig. 1*).—This brief presentation of the method and results of experimentation claims that success was attained in promoting, electrically, separate physiological processes in *Phaseolus multiflorus*. By increase of the atmospheric ionization, assimilation, transpiration, and the uptake of nutritive salts were augmented, with the result that growth and dry weight were increased.

The influence of electricity on plants [trans. title], G. LIPPERHEIDE (*Angew. Bot., 9 (1927), No. 6, pp. 561–625, figs. 22*).—A review, with extensive bibliography, is given of studies beginning as early as 1783, also an account of work extending through 1926, bearing on the effects of electricity on plant development.

Increased ionization of the air favors plant growth. Ozone shows an adverse influence. Salt uptake is increased by air ionization, as are also assimilation and transpiration.

Pollen cytology and germinability in Prunus and Rubus [trans. title], N. CHOMISURY (*Angew. Bot., 9 (1927), No. 6, pp. 626–636, figs. 15*).—A fact which became apparent in the details here given is that in certain cases berry size increased with increase in chromosome number.

GENETICS

Chromosome characteristics of Malus ioensis and one of its large fruited forms, T. J. MANEY and W. A. WELTER (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 115, 116, pls. 2*).—The origin of large-fruited types of the indigenous Malus species being in doubt, cytological studies were made at the Iowa State College of the developing flower buds of the Mercer County crab and of *M. ioensis*. The latter was found to have 14 pairs of chromosomes, while the Mercer County seedling was somewhat variable, with from 13 to 15 pairs. Reduction was often abnormal in the Mercer County seedling, 5 or 6 microspores per tetrad being not unusual, with the size of the individual microspores also variable, leading to the suggestion that the Mercer County crab is probably a hybrid between the native *M. ioensis* and some variety of the common apple.

Pollination and fertilization of celery (preliminary report), S. L. EMSWELLER (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 29, 30*).—Self-pollination of the individual flowers of celery was found in studies at the California Experiment Station to be precluded by complete protandry. The period of receptivity of the stigmas was observed to continue for several days, a supposition borne out by cytological examination. The embryo sac was found to be nearly mature at the time the flowers were fully open. Four and one-half days after anthesis when the styles were fully erect the embryo sac was mature, but it was not until approximately eight days following anthesis that fertilization had generally occurred. The somatic chromosome number as observed in the root tip cells was 22 and the gametic number in the pollen mother cells 11.

The behavior of pollen tubes in self and cross pollination, J. R. COOPER (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 138–140*).—Cytological examinations at the Arkansas Experiment Station of selfed and cross-pollinated apple

blossoms showed that the average rate of growth of the pollen tubes in selfed pistils is definitely slower and the number of tubes reaching the locules is much smaller than in crosses. In the case of Ben Davis and Jonathan pistils, Delicious tubes made the greatest average length. In Stayman Winesap and Delicious pistils, Ben Davis pollen tubes developed the most rapidly. The length of time required for germination under like conditions was practically the same for the several varieties of pollen. Differences in rate of growth of the pollen tubes were not very noticeable until from one-fourth to one-third the distance down the style was traversed. The gain in the rate of growth beyond this point in crossed blooms is attributed to increased nutrient supply, apparently derived from the conductive tissues. Cessation of growth followed by the enlargement of the end of the pollen tube was observed in both selfed and crossed flowers but much more frequently in the former. The course of the pollen tube was generally down over the placenta and the funiculus to the micropyle.

Progeny resulting from self-pollination of staminate plant of Morus alba showing sex reversal, J. H. SCHAFFNER (*Bot. Gaz., 87 (1929), No. 5, pp. 653–659*).—An examination of the first six trees to blossom among 32 derived from self-pollination of flowers on reversed staminate branches of the white mulberry showed one to be pure staminate for two years, one pure staminate the first year, and of mixed sex the second, two purely carpellate, and two carpellate with a slight development of staminate catkins. The original parent was apparently not male due to any sex-determining heredity present, since it proved to carry potentialities for both sexes. The six seedling trees derived from a selfed staminate plant thus exhibited all possible general sex conditions, pure female, pure male, female with reversed branches, and male with reversed branches.

The physiology of self-sterility in plants, E. M. EAST (*Jour. Gen. Physiol., 8 (1926), No. 5, pp. 403–416, figs. 2*).—A comparative discussion of views and of interpretations of previous work, some of which was participated in by the author (E. S. R., 58, p. 28).

"When thus simplified it is clear that self-sterility, and its corollary cross-sterility, is controlled by a limited number of hereditary factors which function in producing differential pollen-tube growth. Self-sterile plants are not specialized individually in this regard, as Darwin and Jost assumed; but they are specialized as groups. The number of groups is unknown. One allelomorphic series containing four members has been proved definitely. Three other possible different members of this same allelomorphic series are now being investigated in order to discover whether they are really distinct from the four already isolated. We will not be certain, however, until many other matings have been completed. . . .

"A second question of some interest is: How do these pollen-tube growth factors act? There is critical evidence on this point. The presence of compatible pollen tubes in the same style with incompatible pollen tubes does not change the latter growth curve materially. . . .

"The indications, therefore, are that easily diffusible substances pass out of the cells of the style and into the membrane of the pollen tube where they can be manufactured into the necessary growth substances, if the two kinds essential for the final reaction are complementary."

Genetical and cytological aspects of incompatibility and sterility in cultivated fruits, M. B. CRANE and W. J. C. LAWRENCE (*Jour. Pomol. and Hort. Sci., 7 (1929), No. 4, pp. 276–301, pls. 2, figs. 5*).—A further and complete report (E. S. R., 58, p. 739) on fruit pollination studies at the John Innes Horticultural Institution.

Three main types of sterility are distinguished, (1) generational, (2) morphological, and (3) incompatibility, in the last of which failure to fruit is not due to inherent sterility but to the failure of the pollen tube to reach the ovules. The number of chromosomes in the root tip of various plum and apple species and varieties is presented, with a comprehensive discussion of the relationships between polyploidy, sterility, and fruit production.

Natural crossing between oat plants of hybrid origin, R. J. GARBER and M. M. HOOVER (*Jour. Agr. Research* [*U. S.*], *38* (*1929*), *No. 11, pp. 647, 648*).—A considerable number of black-seeded plants found at the West Virginia Experiment Station among supposedly white-seeded (F_4) families of Gopher × Black Mesdag oats appeared to be natural hybrids. The percentage of natural hybrids between black and white seeded forms is estimated to have been 0.54 per cent. See also an earlier note (E. S. R., 57, p. 29).

Hybridization in the genus Ribes [trans. title], P. LORENZ (*Züchter, 1* (*1929*), *No. 2, pp. 66–68*).—Pointing out that the high degree of interfertility between species of the Ribes genus affords unusual opportunity for crossing experiments, the author discusses various breeding combinations. In crosses between mildew-resistant American and mildew-susceptible European forms all of the F_1 plants were susceptible, while in the F_2 some almost completely resistant forms appeared. Resistance is considered to be trifactorial and recessive, about 1 in every 60 of the F_2 plants being resistant.

All sorts of growth types occurred in the F_2 from normal bushes to creeping dwarf forms often with malformed leaves. Some very vigorous F_1 hybrids deemed of use as rootstocks for high-stemmed gooseberries appeared in a *R. divaricatum* and *R. oxyacanthoides* cross. Citing the existence of thornless gooseberries, such as Souvenir de Billard, and of various slightly thorned forms, the author asserts that thorniness is apparently determined by a series of similar genes. In any large F_2 generation there always occurred some more or less thornless seedlings. Combined thornlessness and good quality are believed a possible attainment.

Sterility was encountered in the F_1 of series of crosses between *R. nigrum* and various European and American species, and even though from 20 to 30 per cent of the pollen appeared normal, back crosses were unsuccessful.

Developmental history of the fruit in lines of Cucurbita pepo differing in fruit shape, E. W. SINNOTT and G. B. DURHAM (*Bot. Gaz.*, *87* (*1929*), *No. 3, pp. 411–421, fig. 1*).—Using as material true breeding pure lines which have been under study for several years (E. S. R., 60, p. 526), the authors noted that the three principal fruit shapes, elongate, spherical, and disk, are clearly distinguishable from the early stage when the ovary primordium is not more than one-millionth of the volume of the mature fruit. Differences in the central carpellary tissue and not in the wall of the ovary and fruit seemed to be the shape-controlling feature. Squashes of the various fruit shapes appeared essentially similar in respect to the size and shape of their component cells, indicating that shape differences are evidently due to a more rapid cell division in certain planes. Since these shape differences are transmitted in typical Mendelian form, the authors conclude that the specific differences in growth correlation which result in the various shapes are due to specific genes.

Inheritance in lettuce, C. E. DURST (*Science*, *69* (*1929*), *No. 1795, pp. 553, 554*).—Crosses made at the Illinois Experiment Station between cultivated varieties of lettuce, including heading, loose leaf, and Cos types, and between these cultivated varieties and a wild form, *Lactuca scariola*, showed decided dominance of certain characters, including anthocyanin pigment, black color of seeds, prickliness, and lobing of the leaves. Morphological characters, such as

leaf width, length, and area, plant height, etc., were found to be inherited in a quantitative manner. Wild forms of lettuce were evidently more heterozygous than cultivated varieties for certain characters. It is believed that in many instances modified and deviating Mendelian ratios are the result of linkage of quantitative genes with those affecting fertility or sterility. It is further believed that cultivated lettuces were derived from the wild *L. scariola*.

Taming the American wild crabapple, N. E. HANSEN (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 123, 124*).—Pointing out the desirability of homozygous parents, of early bearing and small tree characteristics in the apple, and the possibilities of recombining inbred lines in the apple, the author briefly discusses the parentage of certain of his apple and crab apple seedlings, some obtained by hybridizing *Pyrus ioensis* and *P. malus* followed by back crossing to the *P. malus* parent.

Further notes on peach breeding, C. H. CONNORS (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 125–128*).—Emphasizing the fact that the peach is not a desirable plant for genetic studies, the author briefly records certain inheritance facts that have been established at the New Jersey Experiment Stations in extensive breeding operations. Among the points discussed are the inheritance of growth habits, of glands, size of blossoms, sterility, date of ripening, flesh color and texture, adherence of flesh, and size of fruits.

Following an earlier report (E. S. R., 58, p. 39), the author again cites sterility results in controlled crosses with J. H. Hale as ovule parent. In two out of four progenies pollen sterility approximated 50 per cent, with none in the other cases, leading to the hypothesis that pollen sterility of this type is evidently recessive to the fully fertile hermaphroditic flower form. J. H. Hale crossed with a purple-leaved peach gave rise to about 50 per cent of purple-leaved seedlings. Elberta crossed with a double-flowered seedling of Lola yielded about 83 per cent of seedlings having accessory petals. Studies of the progeny obtained by placing two varieties of pollen on Elberta stigmas showed no selective power on the part of the stigmas. J. H. Hale was successfully crossed with *Amygdalus kansuensis*, a Chinese bush peach, but the seedlings were of no value. J. H. Hale and Goldmine nectarine were successfully crossed with the thick-shelled almond. The named seedling peaches Pioneer, Cumberland, Eclipse, and Golden Jubilee, are described as highly promising.

Genetic studies in sheep and swine, B. L. WARWICK (*Ohio Sta. Bul. 431 (1929), pp. 122, 123*).—The inheritance of black in sheep was found to behave as a simple recessive Mendelian factor, while "chalk-face" behaves as a simple dominant. In inbreeding experiments with swine, the fourth generation of parent offspring matings has been obtained, and in this connection new characteristics are reported.

FIELD CROPS

The maintenance and improvement of permanent pastures, B. A. BROWN and W. L. SLATE (*Connecticut Storrs Sta. Bul. 155 (1929), pp. 149–250, figs. 30*).—The factors involved in the maintenance and improvement of permanent pastures are considered in the first part of this report, together with a review of literature on permanent pastures in humid temperate climates embracing 37 titles.

Although opinions differ greatly and little experimental data exists in regard to rates and time of grazing, rotational and mixed grazing, and related practices, most of the evidence on grazing pastures in humid regions has favored reasonably heavy to light grazing. Mixed and rotational grazing usually have brought better returns. Cultural practices, e. g., plowing, harrowing, and re-

seeding, either alone or in combination, have given disappointing results unless fertilizers were applied in addition.

Fertilization appeared the prime consideration in the improvement of most pasture land in northwestern Europe or northeastern United States. Of elements commonly deficient in the soil for optimum plant growth, phosphorus has been the most needed in pastures. Calcium, in one of the forms of lime, generally has increased the productivity of pastures, sometimes alone, but more often when applied with a phosphorus carrier. Relatively low in phosphorus and calcium, farm manure alone is not efficient for top dressing worn out pastures. The heavier soils have given little if any response to potassium, while on the lighter soil types, less suitable for permanent pastures, potassium has been beneficial. On the same soils this element seems of much less importance for pastures than for meadows. Nitrogenous fertilizers have not been beneficial in all instances. In the United States some benefit usually has been obtained from including nitrogen with the minerals, but few decisive comparisons were had under real pasture conditions.

The effects of fertilizers on the soil reaction, the flora, and the production, as measured by grazing, discussed in part 2 of this report, was studied at the station from 1921 to 1928 on typical run down, rough land, described as Charlton loam, quite retentive of moisture and good grassland, although very acid (pH 5.2) and very deficient in available phosphorus. Plats were cleared and grazed uniformly to measure differences in productivity until April, 1924, when limestone was applied at 2,000 lbs., superphosphate at 500 lbs., potassium chloride at 100 lbs., and sodium nitrate at 150 lbs. per acre. These materials were applied alone, excepting the nitrate, and in combination. Only plats receiving nitrogenous fertilizers have had any treatments since 1924. No cultural treatments have been given nor seed of any kind applied.

Yearling steers, usually of Shorthorn breeding, have been used to graze the plats, and the yields and nutritive value of the herbage have been measured by the pounds of live weight maintained and the gains in weight. The steers were weighed on 2 successive days at the end of each period of about 15 days and moved to a different plat after the second weighing. The range between the highest and lowest gain per steer has averaged 146 lbs. during the period 1921 to 1928. Choosing groups of steers at random, the probable errors of their average gains on pasture, 150 lbs. per season, during 7 years were found to be 6 lbs., or 4 per cent, with 20 steers; 8 lbs., or 5.3 per cent, with 10 steers; and 13 lbs., or 8.6 per cent, with 5 steers. The basing of pasture production on both the maintenance and gains of the animals has tended to reduce the errors arising from grazing plats over or under the optimum rate, from the differences in the ability of individual animals to increase in weight, and from the variability of the vegetation under different treatments.

Limestone, top-dressed in 1924, reduced the pH acidity of the surface 2 in. of soil by 0.2 in 1926 but apparently had no appreciable effect on the 2- to 6-in. horizon. Available phosphorus was very low in the pasture, only traces being found in 1926 where no superphosphate had been applied. No effects of the superphosphate treatment were observed below the surface 2 in. More available phosphorus was found on plats receiving both superphosphate and limestone than on those treated with superphosphate only.

White clover has spread markedly on plats receiving superphosphate or superphosphate and limestone. The vegetation furnished by this plant in 1927 and 1928 was estimated to average for superphosphate 18 per cent; superphosphate and limestone 40; superphosphate and potassium 13; superphosphate, limestone, and potassium 37; superphosphate, potassium, and sodium nitrate 19;

limestone and potassium 7; and no treatment 2 per cent. In general, Kentucky bluegrass has also increased where white clover has spread and reductions have taken place in the less desirable grasses and weeds. Clover has decreased since 1925 on plats which received superphosphate without limestone but not appreciably where both materials were applied.

On the average corrected thermal production, superphosphate alone increased the pasturage 64 per cent; superphosphate with limestone 120; superphosphate and potassium 86; superphosphate, limestone, and potassium 128; and superphosphate, potassium, and sodium nitrate (applied annually) 103 per cent. Sodium nitrate did not affect production the year after its application. Indications in 1928 were that plats which received superphosphate or superphosphate and limestone in 1924 would continue to yield much more than those not so treated.

With clover hay at $18 and corn silage at $6 per ton, the value of these feeds replaced by one acre of unfertilized pasture has averaged $13.50 during the years 1924–1928. Distributing the cost of the fertilizers over the five years, pasture receiving superphosphate returned $10.10 per acre per year more than untreated land at an annual cost of $1.30; limestone $5.28 per acre per year at an annual cost of $2; and sodium nitrate and ammonium sulfate $6.90 per acre per year at an annual cost of $6.25.

Relation of soil moisture to the summer use of land, H. H. Finnell (*[Oklahoma] Panhandle Sta., Panhandle Bul. 6 (1929), pp. 3–7*).—The summer use of land of heavy soil type evidently should be determined largely by the soil moisture present during June. While summer fallow uses rainfall efficiently if the available moisture of the soil is exhausted, it may be wasteful if considerable usable moisture is present early in summer. Experiments over a number of years showed that milo or similar grain sorghums usually may be produced following a soil moisture condition either favorable or unfavorable to summer fallowing. The highest milo grain yields have been obtained by planting in 3.5-ft. rows when the June soil moisture is average (about 14 per cent) or above and in 7-ft. rows when it is below the average.

[Farm crops work at the Michigan Station], J. F. Cox and B. R. Churchill (*Michigan Sta. Rpt. 1927, pp. 356, 357, 373–375*).—O. A. C. white wheat, Spartan barley, a late-blooming sweetclover, a sport-free red kidney bean, and variegated alfalfas were promising among the crop varieties tested.

Fall plowing has proved much better than spring plowing for sugar beets. With beets blocked carefully with bunches 12 in. apart and thinned to the strongest plant, yields exceeding 4 tons to the acre more than fields blocked and thinned in the ordinary way have been obtained.

In curing studies, hay cured in loose windrows dried down much more uniformly than where partially cured in the swath. When cured in the windrows the leaves and stems lost moisture at about the same rate, while hay swath cured showed a divergence of as much as 10 per cent in moisture content between the leaf and stem, the leaves drying rapidly while the stems retained much moisture, a condition causing loss of leaf and often spoilage in the mow.

Variety tests with oats, barley, corn, alfalfa, field peas, potatoes, and root crops are reported on from the Upper Peninsula Substation.

[Field crops experiments at the Raymond, Miss., Substation, 1928], H. F. Wallace and J. L. Cooley, Jr. (*Mississippi Sta. Bul. 262 (1928), pp. 3–16, 17–25, 36–39, fig. 1*).—Variety trials with cotton (E. S. R., 59, p. 824) continued over several years showed Cleveland 54, Cleveland-Wilson, Miller, Lone Star strains, D. & P. L. 4, and Acala to be good for hill land and Delfos 6102 and its progenies, Lone Star strains, D. & P. L. 6, Cleveland 54, Express 121,

Miller, and Rowden 40 for valley land. The use of 600 lbs. of an 8-6-4 (P-N-K) fertilizer for general application is indicated for good results, with modifications advised for certain conditions. A highly concentrated fertilizer (30-15-15) gave about as good results as stock run commercial (8-4-4) fertilizer. Calcium nitrate, urea, and sodium nitrate led the nitrogen sources in increased yields of seed cotton, and potassium chloride, potassium sulfate, and kainit ranked in order as potassium carriers. Spacing tests during four years suggested from two to three stalks in bunches per foot in 3.5-ft. rows on valley land and from three to five stalks in bunches per foot in 3-ft. rows on hill land.

Delta Mosby and Fisher Paymaster led corn varieties in 1928 and Laguna and Cocke Prolific led in 7-year average yields. Calcium nitrate and sodium nitrate were first among the nitrogen carriers for corn. A general fertilizer recommendation for corn is a mixture of superphosphate 100 lbs., sodium nitrate or calcium nitrate or equivalent 150 lbs., and potassium chloride 50 lbs.

Other activities noted are seed treatment tests with corn, interplanting of corn and beans, an alfalfa fertilizer trial, and tests of varieties and strains of soybeans and potatoes (E. S. R., 60, p. 735). The merits of vetch in rotation with other crops and of other legumes and of pasture grasses and clovers are discussed briefly.

[Field crops work at the Holly Springs, Miss., Substation], C. T. Ames and O. B. Casanova (*Mississippi Sta. Bul. 264 (1928), pp. 6-35, 36-40, figs. 7*).—Noteworthy varieties in continued experiments (E. S. R., 60, p. 34) included D. and P. L. No. 4, Lone Star 65, Acala No. 5, Cleveland 54, and Miller for short cotton, and the staple varieties Delfos 631, Lightning Express, and D. & P. L. No. 6; Hastings Prolific, Neal Paymaster, Mosby (Station), and Cocke Prolific and Large Golden Dent (Station) corn; Japanese (Honey) and Texas (Gooseneck) seeded sorgo; Nancy Hall sweetpotatoes; Laredo, Otootan, Biloxi, and Mammoth Yellow soybeans; and Kobe lespedeza.

Fertilizer trials with cotton have indicated for improved soils manured or bearing legumes from 600 to 900 lbs. per acre of a mixture of superphosphate 300 lbs., sodium nitrate or equivalent 160 lbs., and potassium chloride or equivalent 50 lbs. On thinner soils the further addition of 80 lbs. of sodium nitrate or equivalent is suggested, and an extra 25 lbs. of potassium chloride or other potassium form for most land in the section, especially where rust prevails. Trials of carriers of nitrogen, potassium, and phosphorus for cotton are noted as heretofore.

Production practices are outlined as usual for the principal crops studied. A fertilizer test with corn and an interplanting trial with corn and soybeans are reviewed briefly.

[Field crops experiments at the South Mississippi Substation], W. R. Perkins, W. S. Anderson, and W. W. Welborne (*Mississippi Sta. Bul. 266 (1928), pp. 3-15, 16-24, 25, 28, 29, 30, 31, 32, 36, 37*).—Continued experiments (E. S. R., 59, p. 325) reported on embraced variety tests with cotton, corn, oats, grain sorghum, sugarcane, soybeans, lespedeza, potatoes, and sweetpotatoes; fertilizer tests with corn, oats, alfalfa, and sweetpotatoes; comparisons of cover crops for cotton; rotations; winter cover crops; and breeding work with sweetpotatoes. Fertilizer tests with cotton dealt with sources of nitrogen, phosphorus, and potassium, rates of application, factory v. home mixed fertilizers, and high v. low analysis.

[Field crops experiments in Ohio], R. M. Salter et al. (*Ohio Sta. Bul. 431 (1929), pp. 17-28, 33-44, 45-47, 48-50, 90-95, 145, 146, 147-151, figs. 3*).—The advisability of combining for corn hill applications of fertilizers with broad-

cast fertilizer or manure, especially on light-colored soils low to medium in productivity, was indicated again. Hill application of fertilizers seemed best adapted to supply the nutrient needs of corn early in growth, while broadcasted applications provide the needs later in the season. Besides yield increases, the development and maturity of the crop was hastened by hill applications, as shown by the shorter period between planting and silking and the lower moisture content at husking. When the hill application was 0, ¼, ½, ¾, and all of the total application, the remainder in each case being broadcast, the efficiency of the fertilizer treatment was highest when either ¾ or all of the total application was placed in the hill.

Alfalfa responded markedly to fertilizers high in potassium used as a top-dressing. The common and the Grimm alfalfas did not differ significantly in their response to different fertilizer treatments.

Spring application of sodium nitrate was more profitable than fall application in supplementing phosphorus and potassium for wheat. Applied at rates of 200, 400, and 600 lbs. per acre, commercial 2–12–2 mixture (N–P–K) was found to be fully equal to one-half these quantities of 4–24–4. Any fertilizer applied to wheat through the fertilizer attachment of the grain drill at seeding produced a larger increase in yield of grain than the same quantity and kind of fertilizer applied as a separate application before seeding.

The Hohenheim system of permanent pasture management recently developed in Europe comprises the division of a pasture into several paddocks, a rotation of the grazing from one paddock to another, and top-dressing the grass with ammonium sulfate at intervals during the season. When ammonium sulfate was applied at different rates and frequencies to a mixed bluegrass and redtop sod at the station, a high efficiency of grass in the utilization of fertilizer nitrogen in production of both dry matter and protein was indicated. The time, frequency, and quantity of the applications were closely related to yield of dry matter and crude protein. The crude protein content of grass harvested rose from 16.6 per cent on the unfertilized plat to 21.7 per cent on the most heavily treated plat, the latter exceeding that of good alfalfa hay.

The results of a season's work with pasture grasses at Columbus indicated that urea, ammonium nitrate, calcium nitrate, and ammonium sulfate applied alone and in amounts carrying equivalent quantities of nitrogen produced practically the same increase in yield of dry matter and protein. Increasing the frequency of application increased total yield very little. An increase in the nitrogen application was followed by a corresponding increase in yield of dry matter and protein.

Clipping tests with lawns showed that clippings left on the ground benefit the grass. During the last two years, especially in the dry period of summer, a grass plat retaining the clippings was decidedly darker green and bore more luxuriant growth than another plat from which clippings were removed. Some evidence was obtained to show that cutting late in the fall is injurious to lawns.

Varieties of corn planted May 13 at Bono varied from 20 to 100 per cent among the different strains in infestation with European corn borer. In a second series planted June 10 infestation ranged from 0 to 80 per cent, the strains that were high in one test tending to be high in the other. When the strains were arranged as to the length of time required from planting to mid-date of silking, the average infestation was found to be about 2.19 per cent less in the first planting and 1.14 per cent less in the second planting for each day of increase in length of the vegetative period of the strain. Early varieties appeared at a disadvantage in that they carried more corn borers and are more readily damaged than the larger, later sorts, but if later planting is practiced

to reduce infestation relatively early varieties must be planted to insure sound and mature corn at harvest.

Clarage corn planted during 17 years at Wooster at weekly intervals from April 24 to 30 to June 1 to 14 gradually dropped in yield from 72.3 bu. for the second week in May to 45.2 for the last planting. The moisture content of ears at husking rose from 30 to 36 per cent. In recent tests varieties requiring the full season for normal development, such as Burr-Leaming, Leaming, and Clarage, usually outyielded shorter season varieties, even when planted late. A tendency for all sorts to drop in yield with delayed planting was evident in three of four years, and the moisture content at husking of late-planted corn was generally higher than in corn planted at the normal date.

In a study of the effect of soil type on infestation with European corn borer, corn that was poor because of low fertility or imperfect drainage of the soil or unfavorable climatic conditions showed a rather low infestation. Early, vigorously growing corn appears to present conditions especially favorable to the accumulation of the corn borer. It was observed that, with other factors equal, where development of corn is rapid because of favorable soil conditions high infestation may be expected.

Corn given ordinary cultivation (2 or 3 in.) has averaged 10 bu. more corn per acre than with deep cultivation (4 to 6 in.) and 13 bu. more than with shallow (1 to 2 in.). At Columbus on Miami silty clay loam cultivation as compared with scraping produced more grain each year and during three years averaged 7.9 bu. more. Cultivated plats did not yield significantly more on Brookston silty clay loam than did scraped plats. Soil moisture and nitrates did not differ significantly in plats receiving the different treatments. Spaced from 1 to 5 plants per hill, thick stands were more productive than thin ones in years favoring corn, while in unfavorable seasons more than 3 plants per hill has reduced yields. Mature corn and soybeans grown together averaged 57 lbs. less total grain per acre than did corn alone, producing 6.6 bu. of soybeans and 48.6 bu. of corn.

Seeding tests with wheat indicated that little difference can be expected in a normal season between 6, 8, or 10 pk. of seed, but that the heavier rate may be of advantage when planted late or when there is winterkilling. With wheat planted during 27 years from September 22 to 25, the optimum date for the section, at from 3 to 10 pk. per acre, the largest average net yield came from 8 pk., with 9 pk. only 0.1 bu. behind. Oats stubble plowed for wheat August 1 to 15 gave noticeably larger wheat yields than later plowings with or without disking.

Wheat ready for the combine contained about 39 per cent of moisture in comparison to 45 in previous years, and the date for safe combining was 4 days later than the binder date as compared to 7 in 1927. Oats and barley again were dry enough for combining 4 days after they were ready for the binder. The moisture content of these grains was highest in the morning and lowest late in the afternoon, and on bright days was usually low enough to permit safe combining after 10 a. m. Losses in standing wheat from shattering were negligible for 10 days after the binder stage, while losses from shattering in oats began at maturity. Barley straw crinkled each year before reaching the date for combining, such crinkling causing loss if the heads dropped low. Additional loss was caused by the heads dropping off after the straw became brittle.

Red clover seeded in the spring on winter wheat by several methods made its largest average yield when broadcasted in April with no attempt to cover the seed. There was no significant difference between seed broadcasted and harrowed and seed drilled, either at a 5- or 10-lb. rate.

Potato plants receiving no manure and no potash in fertilizers became stunted in midseason, produced small tubers, and died prematurely with a characteristic abscission of the lower leaves. Their abnormal dark green color was due to an accumulation of blue pigment normally present in small amounts in varieties of the Rural group. Varieties without this blue pigment became bronzed instead of bluish green. Analyses of the tops of such plants disclosed an accumulation of soluble sugar and a deficit of hydrolyzable polysaccharides. Qualitatively the carbohydrates seemed to be normal. It was apparent that in the growing plant the conversion of soluble sugar to polysaccharides is hindered by the lack of potassium, and as a result of the accumulation of sugar, glucosidal pigment is produced in abnormal quantity and presumably normal photosynthesis is retarded. Tests during two years showed that the same number of sprouts may be obtained more economically by small potato sets spaced close in the row than by larger sets spaced farther apart. Within the range of from 0.5 to 2 oz. in weight, sets less than 1 oz. produced perceptibly weaker sprouts, while those larger than 1 oz. produced more sprouts but without difference in the vigor of the individual sprouts.

Sodium chlorate was used effectively on Canada thistle and quack grass on county experiment farms.

Other activities commented on briefly as heretofore (E. S. R., 59, p. 222) are the production of hybrid wheats resistant to lodging, seeding tests with oats and barley, attempts to develop a longer-lived sweetclover, variety tests with corn and oats, a study of the effect of cleaning up for corn borer on the following oats crop, soil fertility studies, a comparison of soybeans v. clover and timothy for hay, effect of sweetclover in increasing subsequent wheat yields, and fertilizer trials in corn, wheat, and hay rotations, and with tobacco.

Tests of small spring grains, C. F. Noll and C. J. Irvin (*Pennsylvania Sta. Bul. 234 (1928), pp. 12, figs. 2*).—Cornellian, Patterson, Victory, Keystone, and New Zealand led oats varieties tested five or more years, and Richland led in tests during the last two years. Patterson and Ithacan, producing about the same, outyielded other sorts in outlying demonstrations. Naked oats nearly equaled Patterson in acre weights of kernels.

Wisconsin Pedigree, Featherston, and Alpha were outstanding among the barleys compared longer than two years. Four new smooth-awned barleys did well during two years, whereas hooded and hull-less sorts yielded rather low. Oats produced more grain per acre and barley more net energy. Spring wheat has been uncertain.

How many cuttings of alfalfa? C. J. Willard (*Ohio Sta. Bimo. Bul. 138 (1929), pp. 74–81, figs. 3*).—Alfalfa was cut five, four, three, and two times per season during four years at Columbus, each series being first cut, respectively, at bud stage, very early bloom, nearly full bloom, and early seed stage, the last cutting on the same date for all systems of harvesting, and the other cuttings on dates dividing the time about equally between the different cuttings. The average periods between cuttings after the first were, respectively, 31, 36, 48, and 88 days for five, four, three, and two cuttings per year.

Three cuttings produced the highest average hay yield, winterkilled little or not at all, and the hay was fair in quality. Two cuttings resulted in heavy loss of yield and reduced percentages of protein and leaves, while four cuttings gave good hay yields and made hay of fair quality, although resulting in certain injury from winterkilling. Five cuttings were too many; alfalfa so cut killed out in winter. The effect of frequent cutting in depleting root reserves was shown in the smaller weight of roots in the more frequent cuttings. There seemed to be no essential relation between the shoots at the crown and the proper time of cutting.

Except in northeastern Ohio, alfalfa in Ohio evidently should be cut at least three times during the season. The last cutting in the fall should be early enough so that the alfalfa may go into the winter with a healthy vigorous growth 10 to 12 in. in height. The first cutting usually should be made at a somewhat earlier stage than the second or third because it ordinarily loses in quality more rapidly than the other cuttings if cutting is delayed. The best practical dates to secure three cuttings of alfalfa have been June 5 to 12 for the first cutting, July 20 to 27 for the second, and September 1 to 8 for the third. The best indications that alfalfa is ready to cut are the slowing up or cessation of vegetative growth and the stage of bloom.

Barley production and varieties for Wyoming, G. Hartman and A. F. Vass (*Wyoming Sta. Bul. 164 (1929), pp. 93–132, figs. 9*).—Cultural and field methods, irrigation practices, and varieties are recommended for barley production on the basis of experiments by the station. The technic and results of these tests are explained briefly.

Barley is the outstanding grain feed crop for the State, yielding more nutrients in the form of grain than any other crop. The best yields in recent years were in a rotation of legumes, potatoes, and grain, with manure applied to the legume before plowing for potatoes. Early seedings of from 1.5 to 2 bu. per acre have given best results, the lighter seedings being advised for dry lands and on irrigated lands when used as a nurse crop. The 6-rowed types of barley, such as Trebi and Coast, are recommended for irrigated lands and the 2-rowed varieties, such as Hannchen, Charlottetown, and Horn, for dry-land farms.

A criterion of the differentiation of varieties or of experimental areas with respect to their capacity to produce seedling stands of cotton, J. A. Harris, G. J. Harrison, and E. K. Lockwood (*Jour. Agr. Research [U. S.], 38 (1929), No. 11, pp. 601–621, figs. 7*).—Pearson's double χ^2 test was shown to be a suitable test for the determination of differences in the seedling stands produced by different varieties of cotton when grown under the same conditions and by the same variety of cotton when grown under different field conditions.

Comparisons between the seedling stands produced by a number of cottons grown under irrigation in southern Arizona showed Pima Egyptian cotton to have a marked superiority over the compared upland varieties in ability to establish seedling stands under the rather saline soil conditions of the Gila River Valley. Sea-island cotton seemed to resemble Pima Egyptian in this respect. See also an earlier note (E. S. R., 59, p. 525).

Oat varieties in California, W. W. Mackie (*California Sta. Bul. 467 (1929), pp. 46, figs. 4*).—Extensive variety trials with oats, in cooperation with the U. S. Department of Agriculture at the station, substations, and on farms in the State, showed that Kanota, producing excellent hay and a high acre yield of groats, was evidently the best variety for adaptation to general conditions. The oats regions of the State are indicated, the comparative behavior of numerous varieties and their agronomic characteristics are brought out in tables, and milling value and varietal adaptation are discussed briefly.

Rate and date of sowing soybeans, H. L. Borst (*Ohio Sta. Bimo. Bul. 138 (1929), pp. 81–86, figs. 2*).—Seeding tests at Columbus from 1922 to 1927, inclusive, gave results indicating that in rows 28 in. apart Manchu or other soybeans with similar sized seed should be sown at the acre rate of from 4 to 5 pk. for seed and 6 to 8 pk. for hay and Peking and like seed 2 to 3 pk. for seed and 4 pk. for hay. For solid sowing an increase of about 20 per cent in these rates is advised.

Results of seed and legume inoculant inspection, 1928, J. G. Fiske (*New Jersey Stas. Bul. 484 (1929), pp. 104*).—The germination percentage,

purity, and other data are tabulated for more than 1,500 official samples of seed of field crops, vegetables, and lawn mixtures obtained during 1928, and the crops, inoculation purity, number of organisms, and viabilities are shown for 69 official samples of legume inoculants.

HORTICULTURE

[Horticulture at the Raymond, Miss., Substation], J. L. Cooley, Jr. (*Mississippi Sta. Bul. 262 (1928), pp. 25–36*).—Conforming with the preceding report (E. S. R., 59, p. 833), this covers for the greater part the results of fertilizer and variety tests with vegetables. Of 17 tomatoes tested, Crystal Springs Market No. 1 yielded the largest fruits, Richards the most fruit, and Foster the largest percentage of early ripe fruits. Some of the varieties displayed considerable wilt resistance. The largest average net returns per acre over a 3-year period were secured with 1,500 lbs. per acre of an 8–5–3 (P–N–K) fertilizer. Over a 5-year period results with potash were such that the inclusion of from 3 to 4 per cent is recommended. In general, sandy soils responded best to potash. In two of the three cases 3 per cent potash was more effective than 6 per cent. Over a 5-year period nitrate of soda was the best source of nitrogen in a 1,500-lb. 8–4–3 application and compared favorably with cottonseed meal in the 2,000-lb. group. Ammonium sulfate was the least effective among five nitrogen materials. That tomatoes can endure heavy doses of nitrate was indicated in the successful use of 3,000 lbs. per acre. The results of a test conducted to determine the effect of nitrate of soda on the shipping quality of tomatoes from Raymond to New York City indicated that larger applications had no deleterious effect and were perhaps helpful.

In fertilizer studies conducted over a 5-year period with garden peas, 1,000 lbs. per acre of a 10–3–3 material gave the best results, and nitrate of soda was the most effective source of nitrogen, both in the 1,000- and 1,500-lb. treatments. Gradus was the most productive of five varieties tested. For snap beans over a like period 1,500 lbs. of 10–3–3 appeared a little better than 1,000 lbs. Nitrate of soda was best in the 1,500-lb. treatment and sulfate of ammonia in the 1,000-lb. Valentine, Wax, and Giant Stringless Green Pod yielded 3,896, 3,849, and 2,648 lbs. per acre, respectively.

[Horticultural investigations at the South Mississippi Substation], W. S. Anderson (*Mississippi Sta. Bul. 266 (1928), pp. 26–29, 30, 32–36, 37, 38*).—From 300 Florida blueberry plants obtained in 1921, three outstanding types were selected for propagation. A test of cardboard cartons for the shipping of blueberries to distant markets indicated that these should prove to be successful packages.

In a quantitative fertilizer study with tomatoes the highest net gains of the year resulted from an application of 450 lbs. of superphosphate, 187 lbs. of Leunasalpeter, and 100 lbs. of potassium sulfate analyzing 6–4–4 (P–N–K). Analyses of four years' records suggest that 1,200 lbs. of an 8–4–4 material per acre has been most profitable.

Data presented for 21 varieties of peaches fruiting in 1928 show Mayflower and Early Wonder to be the first to ripen and Hiley by far the most productive. Apples suffered severely from various diseases. The Pineapple pear fruited heavily. Under cultivation the Green Ischia fig was the most fruitful variety. Muscadine grapes proved very satisfactory, while varieties such as Concord and Niagara failed to survive. Satsuma oranges were defoliated by two days of 16° F. in January. The Marumi kumquat proved hardier than the Satsuma orange and bore fruit. Oranges, grapefruits, and lemons were killed back to below the soil mound. The Van Fleet raspberry and the Thornless and

young dewberries proved promising. Munson was the only plum found worthy of recommendation. Under a system of mulching without fertilizer several of the northern blueberries gave promise of success. General notes are presented on various fruits, nuts, and vegetables.

[**Horticultural investigations at the Ohio Station**] (*Ohio Sta. Bul. 431 (1929), pp. 80–85, 86–93, 95–99, 146, 147, figs. 2*).—The usual annual report (E. S. R., 59, p. 231).

Preliminary results obtained by J. H. Gourley in an experiment on the influence of nitrate of soda on the storage behavior of apples gave no indication that Stayman Winesap treated with five times the normal application of nitrate of soda decayed more quickly than did apples from untreated trees. The apples from the highly fertilized trees were not quite as well colored and showed a small amount of scald.

Studies by F. S. Howlett on the relation of the leaf surface of the secondary shoots arising from the fruit bud to abscission of the fruits in the June drop indicated that the spur leaf area may be considerably decreased without appreciably reducing the remaining fruits, provided the secondary shoot leaf surface is left intact. The secondary shoot appeared to have a marked effect in maintaining fruits on the spur if the spur leaf surface is reduced. The growth of the secondary shoot appeared dependent on the vigor of the branch or the tree as a whole rather than on fruiting conditions in the spur itself. Thinning of the fruits following first drop reduced subsequent losses. Studies of fruit setting in the Delicious apple showed a considerable percentage of aborted terminal flowers, competition for nutrients and water being apparently sufficiently keen to reduce the set and suggesting the need of keeping the Delicious apple in a vigorously growing condition by pruning and fertilizing. Further studies upon the dropping of flowers in Stayman Winesap and Winesap showed that these varieties also require substantial pruning and fertilization to keep them in a satisfactory fruiting condition. A program of treatment is suggested.

Howlett, as did Caldwell (E. S. R., 46, p. 736), found that the branches of young Bartlett pears tied down to a horizontal position blossomed more profusely that did upright branches. Studies by Howlett and C. May of the effect of liquid lime sulfur and Bordeaux on fruit dropping in Grimes and Ensee apples indicated that these materials in certain strengths cause some dropping even though the foliage is not visibly injured, but that neither spray was a serious factor with these two heavy setting varieties.

Apple variety testing conducted by C. W. Ellenwood included observations on more than 500 named varieties and 100 Ohio seedlings. The Golden Delicious is deemed promising when properly handled. Data on the amount of spray required per apple tree are again presented (E. S. R., 59, p. 140).

As established by J. S. Shoemaker, a considerable number of June runners in the Howard 17 strawberry is an indication of large production for the season. The maximum production of runners was attained in August.

Fertilizer studies with flowers conducted by W. W. Wiggin showed that various species have definite requirements. Pot plants in general responded better to chemicals, such as nitrate of soda, than to liquid manure. Among chemical fertilizers a mixture of 4–12–8 (N–P–K) proved satisfactory for field-grown flowers. Peat moss proved promising as a substitute for manure in soil modification. Comparisons of sand, slag, peat moss, sphagnum moss, and combinations thereof as rooting media for cuttings indicated that watering, shading, and heating are of more importance than the medium itself. Internodal cuts proved better than nodal cuts, and the trimming of cuttings was of no benefit. Cuttings from plants grown in partial shade and nitrated

rooted better than did those taken from plants in full sunlight and without added nitrates. Soft texture aided rooting. In respect to soil reaction wide variation was noted in species response. Cyclamens and hydrangeas grew best in acid soil. Soil reaction was maintained at a given point with difficulty. In raised beds, fresh, unsterilized soil as compared with unchanged sterilized soil did not give enough increase in the size of chrysanthemum flowers to warrant the change. The close planting of pompons and anemone types increased returns but also increased disease hazard. Pinching late in the season decreased the number of blooms.

Comparing December and January for sowing tomato seed, I. C. Hoffman found that with plants set in the beds on February 17, December-sown plants matured fruit somewhat earlier, thus offsetting the greater total yield of the January plants. Pruning off the healthy leaves at the base of tomato plants in an effort to reduce disease did not lessen this hazard and did delay ripening and often reduced yields materially. Mulching greenhouse tomatoes with various materials, such as rotted horse manure, fresh strawy horse manure, and horse manure with shavings gave negative results. In no case did the mulches return sufficient yields to warrant the practice and in certain cases retarded the growth of fruits and reduced the total yields in comparison with unmulched plants.

Studies conducted by R. Magruder at West Jefferson suggested the desirability of close planting of sweet corn, both in the case of three and one plants per hill. Not only the largest yields but also the largest percentage of first-grade ears were produced by close planting. Records taken by Magruder on 41 varieties of white and yellow sweet corns showed wide variation in the growth period and in the average weight of ears. All of six papers, three regular mulch and three building papers, lasted throughout one season in the garden but were of no further value. One of the building papers proved injurious to the early growth of certain plants, presumably because of toxic contents, and two of the mulch papers shrank in size and curled at the edges. Potatoes, beans, cucumbers, and sweet corn were the only early planted crops in which paper mulch stimulated germination. Spinach, lettuce, beets, peas, celery, cauliflower, and potatoes were visibly larger on the paper mulch plats, and the maturity of spinach, beets, carrots, cabbage, beans, eggplant, and sweet corn was hastened with black paper. As recorded by a soil thermograph, at 2-in. depths on bright days in the early season there was as much as 8° F. increase in temperature at 4 p. m. under paper, with no consistent differences in cloudy or rainy periods. In midseason the differences were smaller but still in favor of paper mulch. Soil samples taken weekly to a depth of 7 in. in the bean and corn rows showed during the period June 9 to August 3 more moisture under the mulch, although there was an abundance of rainfall during this period. Nitrate nitrogen content averaged slightly higher under cultivation for both crops, with greatest differences in the early part of the period. Nitrates were much higher between the rows than in the row.

A comparison at the Hamilton County Experiment Farm of cultivation and sod in an apple orchard showed greater net returns in the first 15-year period from cultivation. At the Mahoning County Experiment Farm the Whipple Early Yellow and the Howling Mob sweet corns were found more satisfactory than earlier, smaller-eared kinds. The Golden Acre cabbage proved desirable.

Suggestions for paper-mulch trials, L. H. Flint (*U. S. Dept. Agr. Circ. 77 (1929), pp. 8, figs. 3*).—Following an earlier technical report (E. S. R., 59, p. 528), the author herein presents practical suggestions concerning the use of mulch paper with a view to assisting in the conducting of trials. It is pointed out that very little is yet known of the soil modifications resulting from the

use of mulch paper and that paper mulch can not be accepted as a substitute for fertilizer or for good preparation of the soil.

Mulch papers are divided according to their durability into two classes, (1) those suitable for single crops, and (2) those suitable for two or more crops or for perennial crops. Methods of applying paper and various economic considerations are discussed, and the need of limited trials before general adoption is again stressed.

The quality of packet vegetable seed on sale in New York in 1926, 1927, and 1928, M. T. MUNN, O. M. HOEFLE, and M. E. WOODBRIDGE (*New York State Sta. Bul. 565 (1929), pp. 47*).—The results are herein presented of the analyses for germination of 964 packets of vegetable seeds collected from 47 seedsmen or dealers in New York State. A total of 9.2 per cent were found to be absolutely worthless for planting, and a relatively high proportion were below reasonable standards of quality; in fact, slightly less than one-half measured up to a desirable quality for planting.

Carrot varieties, R. MAGRUDER (*Ohio Sta. Bimo. Bul. 138 (1929), pp. 97–99, fig. 1*).—Descriptive notes are given for nine varieties of table carrots, namely, Amsterdam, Coreless Forcing, Nantes, Chantenay, Select Danvers, Bagly, Hutchinson, Pride of Denmark, and Perfection.

Tomato quality as influenced by the relative amount of outer and inner wall region, J. H. MACGILLIVRAY and O. W. FORD (*Indiana Sta. Bul. 327 (1928), pp. 28, figs. 7*).—With tomato fruits divided into five parts, (1) outer wall and inner wall, (2) inner locule tissue, (3) pulp around the seed, (4) seed, and (5) skin, determinations were made of the relative amounts of the several portions in different varieties at various times during the picking season. These records were supplemented with chemical analyses.

The outer and inner wall region was found the most valuable portion of the tomato because this part contained the highest percentage of dry matter and of insoluble solids red in color and had the sweeter taste. The outer and inner wall region also contained the largest percentage of iron. Varieties were found to differ in quality chiefly because of the differences in the percentage of dry matter and of the outer wall portion. The better quality often noted in early ripening fruits within any given variety is thought due to the larger percentage of outer and inner wall tissue and the smaller percentage of waste at that time. Varietal differences were noted in the amounts of the several regions; for example, Marglobe seemed to produce consistently a large proportion of the desirable outer and inner wall region, while other varieties were consistently low.

The highest percentage of ash was found in the jelly-like pulp region. High sugar content and high acid content were not associated in the same parts of the fruit; the outer and inner wall portion, for example, possessed a high percentage of sugar and a low percentage of acid, with an opposite condition in the jelly-like pulp. The inner locule was intermediate in acid and sugar.

Propagation of trees and shrubs, G. E. YERKES (*U. S. Dept. Agr., Farmers' Bul. 1567 (1929), pp. II+52, figs. 39*).—A general discussion upon the principles and practices of propagation of woody plants by seeds, cuttings, layers, buds, and scions, with specific information on the accepted practices with various ornamental trees and shrubs. Desirable stocks are suggested for various orchard fruits.

The setting of tree fruits, J. H. PAINTER [*(Oklahoma] Panhandle Sta., Panhandle Bul. 6 (1929), pp. 7–12, fig. 1*).—A popular discussion of the biology of fruit flowers, the physiology of pollination and fertilization, causes of failure to set, the function of bees, etc.

Orchard spraying in West Virginia, E. C. SHERWOOD and L. M. PEAIRS (*West Virginia Sta. Circ. 54 (1929), pp. 31, fig. 1*).—Discussing the various

insect and fungus pests of orchard trees in West Virginia and the nature, preparation, and application of common insecticides and fungicides, the authors present spray schedules for the apple, pear, peach, plum, and cherry.

[**Horticultural investigations at the Michigan Station**], V. R. GARDNER (*Michigan Sta. Rpt. 1927 pp. 361–364*).—In presenting a brief progress report it is stated that light pruning of bearing apple trees was found to be the best procedure.

Treating winter injury of apple trees, H. M. WELLS (*Michigan Sta. Quart. Bul. 11 (1929), No. 4, pp. 188–192, figs. 3*).—The percentages of successful recovery in the case of seven treatments, (1) cleft grafting, (2) bridge grafting, (3) approach grafting, (4) cutting off and allowing to sucker, (5) bark removed and tissues covered with elastigum, (6) bark removed and tissues painted, and (7) no treatment, compared in a block of winter-injured Golden Delicious apple trees were 33, 39, 14, 22, 0, 0, and 25, respectively. The removal of injured bark followed by covering with gum or paint was therefore a complete failure. It is suggested that bridge grafting and approach grafting might have been more successful if the trees had been supported against the wind. Winter injury is conceded more serious than mouse damage because of the harmful effect on internal tissues. Golden Delicious is recorded as lacking in hardiness for Michigan conditions.

Growing Satsuma oranges in south Mississippi, W. S. ANDERSON (*Mississippi Sta. Bul. 265 (1928), pp. 15, figs. 14*).—Attention is given to the choice of site for the grove, the preparation of the soil, selection of varieties, choice of nursery stock, planting, pruning, general culture, pest control, winter protection, harvesting practices, etc.

English walnut production in Oregon, C. E. SCHUSTER (*Oregon Sta. Circ. 91 (1928), pp. 48, figs. 24*).—General information is presented on the status of walnut growing in Oregon, the location of the orchards, soil and temperature requirements, propagation, planting, culture, pruning and training, top-working, harvesting, preparation for market, control of insects and diseases, etc.

Flowers for the Panhandle country, J. H. PAINTER (*[Oklahoma] Panhandle Sta., Panhandle Bul. 5 (1929), pp. 12–16, fig. 1*).—A popular discussion concerning adaptable varieties and their culture.

FORESTRY

[**Forestry investigations at the Michigan Station**], A. K. CHITTENDEN (*Michigan Sta. Rpt. 1927, pp. 358–361*).—The average annual growth in a white pine plantation 34 years old was 113.4 cu. ft. per acre. It was found that poultry manure was an excellent fertilizer in the forest nursery, the seedlings so treated weighing twice as much at the end of the first year as did those where other fertilizers were used. The prevention of damping-off was best accomplished by the use of sterile sand as the top layer in the seed bed.

[**Forestry investigations at the Ohio Station**] (*Ohio Sta. Bul. 431 (1929), pp. 152–167, figs. 3*).—Activities for the year (E. S. R., 59, p. 234) included the purchase of 3,930 acres of State forest land and 496 acres of forest park land, the planting of 473,600 trees of various species, and the improvement of public forests by roads, etc. To date 182 owners of an aggregate forest area of over 15,000 acres have been granted tax reduction privileges under the Ohio Forest Tax Act.

Soil moisture studies in pastured and unpastured portions of a homogeneous forest area showed more moisture in the pastured soil, with fluctuations following heavy rains. Moisture readings in the leaf litter and humus layer in unpastured woods indicated that this layer is partly responsible for the better

growth in unpastured areas. Evaporation was lowest in the unpastured woods and highest in the open fields, and in the pastured woods from 20 to 30 per cent greater than in the unpastured. After three years of fencing there was found a large influx of undesirable forest species, suggesting that all weed trees should be removed before or at the time of excluding animals, or at least the owner should await a heavy seed year of desirable species before fencing. Measurements in seven typical Norway spruce shelter belts in central western Ohio showed an average annual height growth of over 1 ft. and an average annual diameter increment of about 0.25 in. An analysis of fire records during the spring showed that the hours from 12 noon to 3 p. m. are about twice as hazardous as earlier or later in the day, suggesting that burning in these hours should be avoided if possible. Tabulated data are presented on the number, size, causes, and losses in forest fires during the year.

Results with tree planting at the Sheridan Field Station, R. S. TOWLE (*Wyoming Sta. Bul. 163* (*1929*), *pp. 77–92, figs. 5*).—This experiment, located on a nonirrigated tract near Sheridan where the average rainfall from 1917 to 1926 was only 15.1 in. and the minimum temperature was −30° F., afforded a critical test. Of several species planted in 1917, green ash and American elm proved most satisfactory, showing over 85 per cent survival and not killing back severely in any year. Chinese elm made the most rapid growth but suffered severely in 1927 and 1928. In later plantings northwest poplar made more rapid growth than did Chinese elm. Russian olive and buffaloberry grew well, with no noticeable killing back. Caragana planted in a row in 1922 and in a shelter belt in 1927 made rapid growth, with no mortality and no killing back. Boxelder proved very satisfactory on low ground or when partly protected by other trees.

Black locust planting, C. T. AMES and O. B. CASANOVA (*Mississippi Sta. Bul. 264* (*1928*), *p. 35, fig. 1*).—A study of records taken on a planting of black locust established in 1909 on gullied land suggested that the trees had returned an average of $3.60 per acre per year over a 20-year period.

Good naval-stores practice, A. CARY (*U. S. Dept. Agr. Leaflet 41* (*1929*), *pp. 4, figs. 4*).—Practical suggestions are offered on the principles and practice of tapping pine trees for naval stores.

DISEASES OF PLANTS

[Plant pathology investigations], G. H. COONS ET AL. (*Michigan Sta. Rpt. 1927, pp. 329–332*).—The senior author, in collaboration with M. C. Carpenter, was able to make decisive diagnoses of species of fungi by the use of the complement fixation method, and for the differentiation of species of Fusarium this method was found to be very exact. Species of Fusarium were also found to respond quite characteristically to some of the aniline dyes, and the behavior of different species of dyes is being studied.

In connection with studies of sugar beet diseases, damping-off in the field was prevented quite largely by seed treatment with mercury dusts. As copper carbonate is recognized as an efficient fungicide the possibility of a mixture of copper carbonate and mercury compounds is suggested.

Investigations by R. Nelson are reported to have shown that bean mosaic, instead of being a single disease, is a collection of diseases, each with its definite symptoms. Studies by R. Diettert have indicated that the bacterial spot disease of Lima beans is caused by *Phytomonas vignae* and that the organism is seed borne.

Tests made by J. E. Kotila of various organic mercury compounds as substitutes for corrosive sublimate for the control of tuber-borne diseases of

potatoes are said to have shown no superiority over the standard corrosive sublimate treatments. Cooperating with the farm crops department of the station, strains of potatoes were produced that are said to be free from all serious virus diseases.

A brief account is given of tests of a strain of celery resistant to yellows caused by *Fusarium* sp.

Botany and plant pathology (*Ohio Sta. Bul. 431* (*1929*), *pp. 51–68*, *fig. 1*).—Experiments by H. C. Young with sulfur and various oxidizing agents for the control of apple scab showed increased effectiveness for odixized sulfur and dry lime-sulfur mixtures. Potassium permanganate caused burning of the foliage when mixed with lead arsenate.

Toxicity tests made by R. C. Williams, Liming, and Young showed that polythionic acids were the only toxic factors in pure commercial sulfur. Sulfurs freed from these acids were nontoxic. When acid-free sulfurs were exposed to the air polythionic acids were quickly formed, but if they were neutralized they were nontoxic.

Young and Tisdale, studying the adhesiveness of sulfur-dust mixtures, found that even light rains removed a considerable portion of the dusts and that adding stickers apparently increased the washing off of the sulfur.

Experiments by P. E. Tilford are said to have shown that copper dusts should be applied to potato plants when they are moist with dew or rain, and that a freshly mixed copper-lime dust was superior to any of the commercial dusts tested. High magnesian lime was found as satisfactory for use in the preparation of copper-lime dusts as high calcium lime. Tests of several fungicides for treating seed tubers for the control of Rhizoctonia and scab of potatoes showed the superiority of corrosive sublimate treatment over some proprietary compounds.

For the control of celery blights by dust treatments, J. D. Wilson found that dusting in the morning with a 20–80 copper-lime dust gave the best results. Adding kaolin or infusorial earth to the copper-lime mixture increased the flow of the mixture through the duster but gave less efficient control of the blights. Straw mulch gave almost no control of blight, but paper mulch checked it to some extent and increased the yield through conserving the moisture during an unusually dry period. The application of fungicides to the soil, instead of on the plants, showed almost no blight control.

Three years' experiments by J. D. Sayre in treating seed corn with Bayer Dust for the control of corn root rot are said to indicate that when good seed corn was used seed treatment did not result in better stands and greater yields with less symptoms of root rot.

A double-walled pot for automatically watering plants was described by Wilson.

Investigations by A. G. Newhall of soil sterilization by forcing steam through tile in soil in greenhouses are said to indicate that tile placed 18 in. apart and covered 15 in. deep were as efficient as where the tile were placed 12 in. apart and covered 11 in. deep, and the wider spacing was much more economical. The same investigator found that where it was inconvenient to sterilize soil infested with nematodes in pots, pans, etc., thorough air drying for several days rendered the soil safe for use.

In a study of humidity as a factor in the control of leaf diseases in greenhouses, Newhall and Wilson found that leaf mold of tomatoes could be controlled by rapidly changing the air in experimental chambers, even when the relative humidity was as high as from 85 to 90 per cent. Where the air was changed less frequently than every 30 seconds, relative humidities as low as from 80 to 60 per cent were necessary to hold the fungus in check. Experiments

are said to be in progress with various types of ventilating systems, and the preliminary results are said to indicate that some form of blower system, with a device for heating the air taken from outside the house, may be found desirable.

Further tests by Sayre confirmed the efficiency of formaldehyde dusts for the control of oat smut (E. S. R., 59, p. 238).

Additional studies by Sayre of the accumulation of iron in the nodes of corn plants (E. S. R., 59, p. 238) showed that iron accumulates in the form of crystals and masses in the nodes of the corn plant around the vascular bundles, in the bundle sheath, and in the surrounding layer of pith cells. The physical and chemical characters of the two forms of iron are being studied.

A study by R. C. Thomas of ceric acid, a substance used as a test for suberin and cutin in plant tissues, is said to have shown that ceric acid is a mixture of fatty acids rather than a definite compound.

The composition of the outer covering of the hyphae of Fusarium was found by Thomas to be a protein-pectic compound, cellulose-fatty-acid complex with a chitin basic skeleton.

Smuts and rusts produced in cereals by hypodermic injection of inoculum, M. G. Zehner and H. B. Humphrey (*Jour. Agr. Research* [*U. S.*], *38* (*1929*), *No. 11*, *pp. 623–627*, *fig. 1*).—The authors report the successful inoculation of barley with *Ustilago nuda*, of corn with *Puccinia sorghi*, and of wheat with *P. triticina* and *P. graminis tritici* by hypodermic injections into the growing tissues.

Smut resistance in hybrid wheat (*Ohio Sta. Bul. 431* (*1929*), *pp. 44, 45*).—The results are given of three years' tests by G. H. Stringfield of resistance to smut of seven varieties of wheat and of hybrids made between the same varieties and Trumbull, a common variety. The hybrids were found to be resistant in practically the same order as their parent plants. The hybrids produced between Ridit, a resistant variety, Klondike, a moderately resistant form, neither of which is adapted to Ohio, and Trumbull showed considerable promise as to resistance.

The effect of the digestive processes of animals on the viability of corn and sorghum smut spores, C. H. Ficke and L. E. Melchers (*Jour. Agr. Research* [*U. S.*], *38* (*1929*), *No. 11*, *pp. 633–645*).—Corn and sorghum smuts were fed to cattle and horses, and the spores in their excreta were tested for germination. It was found that the passage of the chlamydospores of corn and sorghum smut fungi through the digestive tract of horses and cattle almost completely destroyed their viability. There was somewhat greater survival of sorghum smut spores than of corn smut spores, probably due to the false membrane which covers the spore mass of the sorghum smut.

The contents of different parts of the alimentary canal of several horses to which smut had been fed were examined to learn in what part of the digestive tract smut spores lose their germinating power. It was found that for the most part spores lose their viability in passing through the stomach. This loss of viability is said to be due to the action of acids in the stomach.

No injurious effect was observed from feeding either corn or sorghum smut to the experimental animals.

Progress report of investigations on diseases of vegetable and ornamental plants, H. M. Wedgworth (*Mississippi Sta. Bul. 261* (*1928*), *pp. 21*, *figs. 3*).—Brief accounts are given of tests, for the most part previously noted, of tomatoes for resistance to wilt and blossom-end rot; the comparative value of corrosive sublimate treatment for control of potato scab; the superiority of Bordeaux mixture for the control of tipburn; the control of black rot of sweetpotatoes with a 1–1,000 corrosive sublimate solution; the transmission of sweet-

potato mosaic in northern Mississippi in a short growing season; the effect of grafting mosaic plants on healthy ones; tests of strains of Jersey Wakefield cabbage for resistance to yellows; tests of strains of stringless green pod beans to blight, in which western-grown seed was relatively free from blight; varietal resistance to bacterial blight of beans; the successful control of gladiolus scab by treating the corms with corrosive sublimate solution 1–1,000; and the control of narcissus root rot by the same method of treatment.

Seed treatment for seed-borne diseases of cotton, H. F. Wallace (*Mississippi Sta. Bul. 262 (1928), pp. 16, 17*).—Comparative tests were made of eight fungicides, including some of the organic mercury compounds, for the control of seed-borne diseases of cotton. The yields of seed cotton are reported, and all plats except one gave increased yields over those which were planted with untreated seed. The largest gains were from plats, the seed for which was treated with iodine preparations.

Seed treatment test, W. R. Perkins and W. W. Welborne (*Mississippi Sta. Bul. 266 (1928), pp. 24, 25*).—A report is given on the efficiency of 9 different organic mercury compounds and 2 iodine mixtures for the control of damping-off and wilt of cotton. Due to a second planting no data were secured on the control of damping-off. None of the treatments reduced wilt infection to an important degree. All plats planted with treated seed yielded more seed cotton than those planted with untreated seed, the calculated increases being from 26 to 108 lbs. of seed cotton per acre.

A prolonged saprophytic stage of the cotton root-rot fungus, G. T. Ratliffe (*U. S. Dept. Agr. Circ. 67 (1929), pp. 8, figs. 5*).—Evidence is submitted which indicates that the fungus *Phymatotrichum omnivorum* is able to live as a saprophyte on decaying tree and cotton roots in the absence of living host plants. This is believed to indicate why a system of clean fallow, even when rigidly maintained for as long as three years, does not insure a satisfactory reduction of root rot where deep-seated infections occur.

Effects of potash fertilizer on cotton wilt, W. R. Perkins and W. W. Welborne (*Mississippi Sta. Bul. 266 (1928), pp. 15, 16*).—The results are given of a series of tests of potash derived from various sources on the reduction of cotton wilt. From an examination of 300 stalks of cotton from each plat an appreciable reduction of wilt was observed. The plats which received kainit and some of the potassium chloride treated ones showed the greatest reduction in the percentage of wilt infection.

Ohio potato diseases, P. E. Tilford (*Ohio Sta. Bul. 432 (1929), pp. 38, figs. 22*).—This bulletin aims to give in a popular way and as completely as possible the symptoms, nature, cause, and methods of control of the various diseases to which the potato plant is subject.

Potato seed treatment experiments on Long Island, with special reference to the organic mercury instant dips, E. E. Clayton (*New York State Sta. Bul. 564 (1929), pp. 32, figs. 3*).—A report is given of experiments carried on during four seasons under field conditions with the most healthy seed that could be secured, ordinary grades of commercial certified seed, scabby seed, black scurf infected seed, blackleg infected seed, and with blight infected seed. The organic mercury compounds were used as dusts, soaks, and instant dips.

The organic mercury treatments were found to increase yields slightly as compared with no treatment or corrosive sublimate treatment. Organic mercury compounds controlled seed-borne scab infection about as well as corrosive sublimate, but they were less effective against black scurf. The efficiency of seed treatments against blackleg could not be determined, as in two successive years the planting of potatoes produced in blackleg-diseased hills gave crops

that were practically 100 per cent healthy. Seed treatment was found to be of value in protecting against seed piece decay and the weak plants that result from decay.

When tested with many farmers under growing conditions, neither the organic mercury instant dip nor the corrosive sublimate soak treatments were profitable enough to justify the added expense and bother of treating. The reasons for this are said to be that seed planted in the Long Island section is the best certified seed obtainable and hence carries a minimum of seed-borne diseases, and that the fields have been used for growing potatoes continuously for many years, resulting generally in scab and scurf infection. The claim that organic mercury compounds increased yields did not prove of practical value, as the average increase in yield in 1928 was only a little over 2 per cent.

Control of common sorghum diseases, H. H. Finnell ([*Oklahoma*] *Panhandle Sta., Panhandle Bul. 5 (1929), pp. 10–12*).—Popular descriptions are given of kernel and head smuts and seed rots of sorghums. For the control of kernel smut and protection against seed rots, treating the seed with copper carbonate dust or with some of the new mercury compounds is recommended. It is claimed that no treatment has been found to prevent head smut.

A monographic study of sweet-potato diseases and their control, L. L. Harter and J. L. Weimer (*U. S. Dept. Agr., Tech. Bul. 99 (1929), pp. 118, pls. 26, figs. 24*).—Extended accounts are given of the diseases of the sweetpotato, the subject matter being grouped under these headings: Diseases caused by fungi, disease caused by nematodes, physiological diseases and diseases of unknown cause, and disease control.

The field diseases are considered with reference to their history, geographical distribution, economic importance, symptoms, and the pathogenicity, morphology, life history, and dissemination of the causal organisms. The storage diseases are treated in a similar manner. The physiological diseases and those of unknown cause are described with regard to their occurrence, extent of damage done, and probable cause. Twenty major diseases and a considerable number of minor ones are treated, and control measures are fully discussed.

A list of over 200 references to literature cited completes the bulletin.

The nematode disease of sweet potatoes, R. F. Poole and R. Schmidt (*North Carolina Sta. Bul. 265 (1929), pp. 16, figs. 8*).—The nematode *Heterodera radicicola* has been found to attack sweetpotatoes, and its presence is indicated by swollen areas on the rootlets, roots, and on potatoes, scablike lesions, ringlike lesions, broken rootlets, darkened tissues, wormy potatoes, and sometimes a reduction in growth and yield. If the infection takes place early in the season, the yields are generally reduced. Late infection is said to affect the edible and market quality of potatoes.

The female worm was found to live overwinter in potatoes under the storage methods practiced in the State. The sprouts become infected from infected potatoes and from infested soils. The dissemination and spread of the nematodes may be readily effected with diseased plants.

Tests are reported of three years' work on infested soil to determine the resistance of varieties to attack. The Jersey and Porto Rico varieties and strains were found to be highly resistant, while the Nancy Hall, White Yam, Southern Queen, Red Bermuda, Red Brazil, and Norton Yam varieties and strains were susceptible. The physical characters, such as vigor and growth, root production, thickness of cortex, pigmentation, and firmness of texture appeared to bear no relation to resistance.

Effect of the mosaic disease on yield and quality of tobacco, with suggestions for control, J. E. McMurtrey, Jr. (*Maryland Sta. Bul. 302 (1928), pp.*

147–158, figs. 6).—The results are given of three years' investigations in cooperation with the U. S. D. A. Bureau of Plant Industry on the effect of mosaic on yield and quality of tobacco. Under field conditions three forms of injury are said to be produced by the disease: Ordinary mottling with light and dark green areas; mottling accompanied by spotting; and blisters, which occur on leaves showing no mottling.

Both yield and quality were found to be reduced by mosaic. The damage done to plants inoculated a month after setting in the field was almost equal to that caused by inoculations at the time of transplanting. Inoculations made about topping time did not materially reduce the yield, but the quality of the product was affected. In every case quality was reduced more than yield.

Infection may be avoided to a large extent by sterilizing the seed beds and plant bed covers, and protecting the beds against insect or other possible carriers. Plants from beds showing mosaic should not be used in transplanting. Handling of cured leaf just prior to or during any of the field operations should be avoided unless the hands are thoroughly cleansed before performing them. Old tobacco stalks affected by mosaic were found to be carriers of the disease, and these should not be used about seed beds or in the field.

Data are presented indicating that the virus is rapidly destroyed in the soil.

Tomato leaf-mold: The use of fungicides for its control in greenhouses, E. F. Guba (*Massachusetts Sta. Bul. 248 (1929), pp. 24, pl. 1, fig. 1*).—Tomato leaf mold caused by *Cladosporium fulvum* is said to be one of the most serious diseases of greenhouse tomatoes in Massachusetts.

Laboratory experiments with a considerable number of fungicides indicated varying toxic effects on the spores of the fungus, and experiments with potted plants showed that some fungicides controlled the disease, copper fungicides, organic mercury compounds, and vaporized sulfur giving the best results. Spraying or dusting is not considered practicable because of the objectionable flavor imparted to the fruit, residue on the fruit, toxicity to the foliage, difficulty of covering surfaces which become infected, lack of conditions necessary to obtain toxicity, and the need of frequent applications.

When tested on a commercial scale only vaporized sulfur gave satisfactory results, and its use is recommended. As the disease was found to be most destructive during the period when there is little or no artificial heat in the houses, the author tested and was very successful with an electric equipment which he devised for vaporizing sulfur. It proved to be a very economical, practical, and effective method of controlling leaf mold in the greenhouse, and it is considered a great improvement over existing methods of dusting and spraying.

Studies on the overwintering and modes of infection of the fire blight organism, E. C. Tullis (*Michigan Sta. Tech. Bul. 97 (1929), pp. 32, pls. 2, figs. 2*).—The results are given of a study of fire blight on the apple, pear, and quince in Michigan.

Overwintering of the causal organism was found to occur usually in the marginal region of the cankers. The dissemination of the organism is brought about by a number of species of insects. Bees are considered an important factor in establishing sources of infection in the blossoming tree, and rain was found to be effective in spreading the disease after these primary sources of infection had been established. Attempts to duplicate twig infection by aphids as reported by other investigators gave negative results in all but 8 out of 800 tests. The period of twig infection was found to be correlated rather closely with rainfall periods. The author claims that infection of healthy leaves is a common occurrence, the entrance being secured through the stomata. Stomatal infection usually resulted in twig blight if the infection occurred in

very young leaves of growing twigs. Leaf spot was found to result if the leaf was nearly mature at the time of inoculation.

The movement of the pathogene in the tissue appeared to be one of mass action, and in no case, in any of the preparations examined were bacteria observed in advance of this matrix.

The most satisfactory control measures consist of the elimination of blighted parts, the use of cultural practices which will induce a moderate twig growth, and the use of resistant varieties as stocks.

Red cedar trees menace State orchards, R. Nelson (*Michigan Sta. Quart. Bul., 11 (1929), No. 4, pp. 199–204, figs. 2*).—A description is given of cedar rust caused by *Gymnosporium juniperi-virginianae*, which has appeared in Michigan. The author suggests that should the disease increase so as to become a menace to commercial growing the cedar trees should be destroyed, as this is the only effective means of control now known.

Spraying and dusting experiments of 1928 (*Ohio Sta. Bul. 431 (1929), pp. 85, 86*).—Spraying and dusting experiments reported by F. H. Ballou for the prevention of apple scab showed that spraying with lime sulfur or dusting with a mixture of sulfur and hydrated lime controlled apple scab when thoroughly applied. Lead arsenate was added to all post-blooming applications. Brooks' spot is said to have attacked certain varieties where scab control was almost perfect, and on the varieties Jonathan and Rome little first-class fruit was produced. Some evidence was found to indicate that sprayed trees were less severely attacked than those that had been dusted.

[Orange rust of blackberries, raspberries, and dewberries], E. A. Bessey (*Michigan Sta. Rpt. 1927, p. 328*).—The author reports that wild blackberries in Michigan are affected with a long-cycle type of rust. The wild dewberry and one plant of cultivated Lucretia dewberry were found to have the short-cycle type of rust. Black raspberries, both wild and cultivated, showed the long-cycle type of rust, with the exception that a small fraction of 1 per cent of germ tubes produced, eventually developed a promycelium at the end of a very long tube. Cultivated blackberries were found to be affected about equally by rust of the long-cycle and short-cycle types. The short-cycle type on Lucretia dewberries and on some of the wild dewberries was two-spored, while on other wild dewberries and blackberries it was four-spored.

ECONOMIC ZOOLOGY—ENTOMOLOGY

The Bosnian-Hercegovinian rat-moles (Spalax monticola monticola Nhrg. and Sp. monticola hercegovinensis Méh.), S. J. Bolkay (*Sarajevo: Hrvatska Tiskara, 1928, pp. 24, pls. 2, figs. 9*).—This is a report of studies of two rat-moles.

Gourds for bird houses and other purposes, W. L. McAtee and J. H. Beattie (*U. S. Dept. Agr. Leaflet 36 (1929), pp. 4, figs. 2*).—This is a practical account.

An account of changes in the earthworm fauna of Illinois and a description of one new species, F. Smith (*Ill. Nat. Hist. Survey Bul. 17 (1928), Art. 10, pp. 347–362*).—This paper includes additions to the list of species previously recorded from Illinois, and also furnishes evidence of obvious changes in the earthworm fauna of one locality which are probably similar to changes taking place in other parts of the State.

[Report of work in entomology at the Michigan Station], R. H. Pettit (*Michigan Sta. Rpt. 1927, pp. 339–356, figs. 17*).—This report consists of notes on the occurrence of and work of the year with the more important insects, in-

cluding the cherry fruit fly, cat-tail borer (*Lymnaecia phragmitella*), parsnip webworm, spindle worm (*Achatodes zeae* Hars.) attacking corn, fringe wing apple bud moth (*Holcocera maligemmella* Murt.), apple maggot, oyster-shell scale, false cabbage aphid (*Aphis pseudobrassicae*), balsam bark beetle (*Pityokteines sparsus*), western pitch-ball making moth of jack pine (*Petrova* (*Evetria*) *albicapitana*), spruce tortrix (*Argyroploce abietana*), spruce bud worm, spruce bud scale (*Physokermes abietis*), spruce gall aphid (*Adelges abietis*), root maggots, green bug, rose curculio, *Cartodere argus*, and *Atropus* sp.

There is said to be doubt as to whether the oriental fruit moth has as yet entered Michigan.

Reference is made to the use of poison bait for cutworms and grasshoppers, prepared by dissolving caustic soda and white arsenic in water as recommended by the Colorado Experiment Station, which was tested with most satisfactory results, as previously noted (E. S. R., 57, p. 558). It was found that the mixture was always successful when a soluble arsenical was used.

[**Work in entomology at the Ohio Station**] (*Ohio Sta. Bul. 431 (1929), pp. 69–79, fig. 1*).—A summary of information is given on the occurrence of and work conducted with the more important insects of the year, including the European corn borer, by L. L. Huber and C. R. Neiswander, a detailed account of which latter pest has been noted (E. S. R., 61, p. 56); other corn insects, including the lined stalk borer (*Oligia fractilinea* Grote) and billbugs of the species *Calendra zeae* Walsh, *C. parvulus* Gyll., and *C. minima* Hart, by Neiswander; the codling moth, by C. R. Cutright and J. S. Houser; the European red mite (*Paratetranychus pilosus* C. & F.), by Houser; apple aphids, namely, the rosy apple aphid, apple aphid, and apple grain aphid, by Cutright; apple leafhoppers, particularly *Typhlocyba xanthippe*, which seem to be on the increase in Ohio, by Cutright; the garden centipede (*Scutigerella immaculata* Newp.) and the red spider (*Tetranychus telarius* L.), both by G. A. Filinger; the potato scab gnat (*Pnyxia scabiei* (Hop.), the beet leaf miner (*Pegomyia hyoscyami* Panz.), the cabbage maggot, and the onion maggot, all by H. L. Gui; and the oriental fruit moth (*Laspeyresia molesta* Busck), by L. A. Stearns and R. B Neiswander. A brief account of the last mentioned insect in Ohio, by Stearns, has been noted (E. S. R., 59, p. 157).

[**Economic insects in the Gold Coast**] (*Gold Coast Dept. Agr. Bul. 7 (1927), pp. 35–48, pls. 7*).—The papers include Notes on Termites in the Gold Coast, by W. H. Patterson (pp. 35–39), in continuation of work previously noted (E. S. R., 57, p. 359); and Life History and Habits, etc., of *Sahlbergella singularis* Hagl. and *Sahlbergella theobroma* Dist. (pp. 40–43) (E. S. R., 56, p. 757), A New Parasite [*Euphorus sahlbergellae* Wilk.] of *Sahlbergella singularis* Hagl. (pp. 44–46), and A New Parasite of *Heliothrips rubrocincta* (pp. 47, 48), all by G. S. Cotterell.

It is reported that in 1925, when the rainfall in the earlier months of the year was abnormal and the rainfall in June considerably above the average, there occurred a heavy thrips infestation with parasitism by a chalcid that reached a maximum of from 70 to 80 per cent.

[**Insect enemies of the yam in Nigeria**] (*Nigeria Agr. Dept. Ann. Bul. 7 (1928), pp. 38–56*).—Notes on the Yam Pest (*Heteroligus claudius* Klug. in the Benin and Warri Provinces of Nigeria, by F. D. Golding (pp. 38–43), is first given, followed by an account of A Dynastid Beetle as a Serious Pest of Yams in the Benue Province of Nigeria, by O. B. Lean (pp. 44–56).

Insects of the flower garden and their control, A. Gibson (*Canada Dept. Agr. Bul. 99, n. ser. (1928), pp. 56, figs. 78*).—This is a practical summary of information.

Lice, mites, and other pests, F. R. BEAUDETTE (*New Jersey Stas. Hints to Poultrymen, 17 (1929), No. 7, pp. 4*).—A brief practical account of these pests of poultry and means for their control.

Lead arsenate studies on cranberry bogs in New Jersey, B. F. DRIGGERS (*New Jersey Stas. Bul. 480 (1929), pp. 36*).—Following a review of the literature, the author reports upon experiments with acid lead arsenate and bog water, lead arsenate and bog soils, and lead arsenate in different spray combinations.

It was determined by suspension in acid waters obtained from cranberry bogs that the solubility of lead arsenate is not greatly increased. This was true even when mixtures of the two were allowed to stand for over a year. Some constituent, or constituents, of the bog water exert a depressing effect on the solubility of the arsenate, perhaps small amounts of iron in the solution. Bog soils high in organic matter produce appreciable amounts of soluble arsenic when lead arsenate is mixed with the soil, but just what reactions take place between the peat soil and the lead arsenate with the liberation of the soluble arsenic have not been determined. "The evidence at hand indicates that the soluble arsenic, if brought about by the organic matter in this soil, was immediately removed from solution by the iron present.

"Three-year spraying tests show that there is no immediate burning of cranberry vines when they are sprayed with lead arsenate and bog water without the addition of any other chemical. Four-year spraying tests with lead arsenate and bog water indicate that there is a cumulative injury to the vines when lead arsenate is used as a spray from year to year. The weight of evidence points to the breakdown of the lead arsenate after it reaches the soil, with liberation of soluble arsenic, which, in turn, is absorbed by the roots of the cranberry plant with resulting injury. Pot experiments in which peat soil and lead arsenate were mixed in proportions as low as 1 part of lead arsenate to 3,000 parts of soil showed a complete kill of cuttings planted therein.

"Considerable amounts of soluble arsenic are brought into solution when lead arsenate, resin fish oil soap, and bog water are used in the proportion of 3 lbs. lead arsenate and 2 lbs. of soap to 50 gal. of water. Field spraying tests showed that the soluble arsenic occurring in such a combination burns cranberry foliage. The nature and degree of burning indicated that cranberry foliage after it becomes cutinized can tolerate a considerable concentration of soluble arsenic.

"Field spraying tests showed that a combined Bordeaux and lead arsenate spray to which is added resin fish oil soap does not produce burning of the foliage. The excess lime of the Bordeaux mixture apparently removes from solution any soluble arsenic produced by the action of the soap on the lead arsenate. Yields over a period of 4 years from sprayed and check plats show that there is a cumulative injurious effect on cranberry vines when a combined lead arsenate Bordeaux soap spray is used."

Studies of arsenical injuries and correctives, J. M. GINSBURG (*New Jersey Stas. Bul. 468 (1929), pp. 16, figs. 3*).—Experiments conducted in the laboratory and the field in 1926 and 1927 here reported upon led to the following conclusions:

"Of all the chemicals tested, zinc oxide proved best in eliminating soluble arsenic from solution. Zinc oxide by itself proved more toxic to peach and apple foliage than did lead arsenate and could, therefore, not be used as an arsenical corrective. Arsenical mixtures containing aluminum oxide, aluminum palmitate, calcium silicate, stannic oxide, charcoal, and powered skim milk,

produced arsenical injury on peach foliage after the first spray application. Arsenical mixtures containing ferric oxide or an excess of hydrated lime did not produce injury on apple foliage and produced slight injury on peach. The spray mixture containing ferric oxide as corrective exhibited remarkable adhesion to peach and apple foliage.

"Chemical analyses of sprayed leaves have shown that considerably more arsenic remained on apple foliage from sprays containing ferric oxide than from sprays containing hydrated lime as correctives. The sulfur was much more readily washed off by rainfall from sprayed apple leaves than was the lead arsenate. Ferric oxide alone, when sprayed in concentrations of 4 lbs. to 50 gal. of tap water, did not cause any injury to peach or apple foliage."

Studies of combined sprays for destroying the overwintering eggs of the European red mite and apple aphids at the delayed dormant period of the apple tree, T. J. Headlee and J. M. Ginsburg (*New Jersey Stas. Bul. 469 (1929), pp. 15*).—In the biological studies, conducted by Headlee (pp. 3–8), it was found that oil emulsion and free nicotine or oil emulsion and crude cresylic acid, 0.5 per cent strength, will give the desired results, both combinations destroying approximately 100 per cent of the eggs of mite and aphids without doing any appreciable damage to the host plant. The apple aphid studies included the oat aphid (*Aphis avenae*), the apple aphid, and the rosy aphid (*A. sorbi*).

The chemical studies, conducted by Ginsburg (pp. 8–15), indicate that more nicotine is evolved from liquid Nico Fume than from nicotine sulfate when mixed with either lime sulfur (1:9) or oil emulsion (3 per cent oil). This higher rate of nicotine volatilization evidently increased the toxic value of the spray against aphid eggs, as shown in the biological tests carried out by Headlee. More nicotine is evolved from nicotine sulfate when mixed with lime sulfur than when mixed with oil emulsion. The combination of lime sulfur and oil emulsion precluded rapid volatilization of nicotine when either nicotine sulfate or liquid Nico Fume was used.

A contribution to our knowledge of the Thysanoptera of India, T. V. Ramakrishna Ayyar (*India Dept. Agr. Mem., Ent. Ser., 10 (1928), No. 7, pp. [3]+217–316, pls. 2, figs. 33*).—Following a brief introduction (pp. 217, 218), the several parts of this work deal, respectively, with previous work on Indian Thysanoptera (pp. 219, 220), material and methods used in this study (pp. 220, 221), the general characters of Thysanoptera with special reference to Indian forms (pp. 221–243), classification (pp. 243, 244), a systematic account of Indian Thysanoptera (pp. 244–313), and a list of species recorded in this memoir (pp. 314–316).

On the effect of the wheat-stem sawfly, *Cephus cinctus* Nort., upon the spring wheat crop in western Canada, A. V. Mitchener (*Sci. Agr., 8 (1928), No. 12, pp. 751–756*).—It is pointed out that in recent years there has been a reduction in the severity of *C. cinctus* infestation in Manitoba in both *Triticum vulgare* and *durum* wheats. It is said to be at least partly due to the modifications which have taken place in the cropping practices of the area, a much greater percentage of *durum* wheat being grown than formerly. The presence of the wheat stem sawfly larvae in the *vulgare* wheat stems does not materially affect the weight of the wheat kernels. In the two years that samples were graded, there was no effect upon the grade in 1922, but in 1925 the grade was reduced for the infested sample from No. 2 northern to No. 3 northern.

The evidence indicates that the effect upon *durum* wheats is similar to that upon *vulgare* wheats.

House fly fumigation experiments with calcium cyanide, C. O. Eddy (*South Carolina Sta. Bul. 256 (1929), pp. 48, figs. 16*).—This is a report of

investigations conducted in continuation of those previously noted (E. S. R., 57, p. 262). Successive lots of house flies were confined in wire cages near the top, at the middle, and near the bottom of a large room fumigated with hydrocyanic acid gas derived from dosages of calcium cyanide varying from ⅛ to 16 oz. per 1,000 cu. ft. One cage was removed from each position in the room and the mortality noted at time intervals so adjusted that it was possible to determine the relationship of exposure and dosage.

The results obtained support earlier findings. The cost of calcium cyanide for 98 to 100 per cent control was nearly twice that required for commercial control.

Life history of the codling moth in northern Georgia, E. R. Van Leeuwen (*U. S. Dept. Agr., Tech. Bul. 90 (1929), pp. 95, figs. 21*).—This is a detailed report, in large part in tabular and chart form, of studies of the life history and habits of the codling moth. The work was conducted at a field laboratory at Cornelia, Ga., during the years 1920 and 1921. The average growing season for the section is 198 days. During the season of 1920 a full brood of the codling moth and three partial broods were produced; whereas, during the following season one full brood and four partial broods were produced. A generalized review of the seasonal history studies for the 2 years is given in chart form, curves representing the normal activity of the different stages.

Two parasites were observed, *Exorista achracea* (V. d. Wp.) and *Ascogaster carpocapsae* Vier. The parasitic insects were found to play a very important part in checking the codling moth in northern Georgia.

The meal worms, R. T. Cotton and R. A. St. George (*U. S. Dept. Agr., Tech. Bul. 95 (1929), pp. 38, figs. 8*).—This is an account of studies of the yellow meal worm and the dark meal worm, particularly of their life history and habits, the details of which are given in tabular form. The account includes descriptions of the mature larva of the yellow meal worm (pp. 25–33) and of the dark meal worm (pp. 33–35), accompanied by illustrations, by St. George. A list of 34 references to the literature cited is included.

The maize billbug in South Carolina (Calendra maidis Chittn.), O. L. Cartwright (*South Carolina Sta. Bul. 257 (1929), pp. 35, figs. 13*).—This is a report of studies conducted from May, 1926, to November, 1928, on plantations in Lee County. The maize billbug has been found to occur in Richland, Sumter, Lee, Kershaw, Darlington, Marlboro, and Chesterfield Counties in the State. Its dispersal is accomplished by crawling, flight, floods, and heavy rains. The pest can withstand for three weeks a complete submergence in water.

"The adults and larvae cause distinct types of injury to growing corn. Injury to poultry attempting to swallow adult beetles was reported. The damage from billbugs varies in all degrees from injury to individual stalks to complete destruction of entire fields. The preferred food of the maize billbug is corn, but adults were observed to feed in the field upon additional plants, millet, milo maize, oats, Johnson or Means grass, crabgrass, joint grass, and other undetermined weeds and grasses. No new larval host plants were observed. Spring emergence takes place from late March to early June. Egg production averages 40 eggs per female. Incubation and oviposition rate are influenced by humidity and temperature. Larvae usually molt 5 or 6 times. Immature stages require 47 to 90 days to mature.

"A wasp, *Cerceris bicornuta* Guer., was found provisioning its nest with adult billbugs. Insect enemies are not effective in control. Crop rotation is the cheapest and most effective means of control."

Dusting cotton with calcium arsenate for boll weevil control.—Second progress report, J. M. Robinson and F. S. Arant (*Alabama Sta. Circ. 53 (1929), pp. 15, figs. 2*).—This is a progress report (E. S. R., 55, p. 857) of experi-

ments with calcium arsenate dust conducted in 1926, 1927, and 1928 on three types of soil. The dust was applied when the infestation reached 10 per cent, all applications being made with a power dust gun.

The increase in yield from dusting on sandy loam soil during the 5-year period 1924–1928 varied from 27 lbs. in 1925 to 773 lbs. in 1927 of seed cotton per acre, the average for the period being 312 lbs. The increase in yield from dusting on Cecil clay soil for the 5-year period varied from 85 (loss) to 597 lbs. of seed cotton per acre, with an average of 282 lbs. The increase in yield from dusting on Houston clay soil for the 5-year period varied from 160 to 372 lbs. of seed cotton per acre, with an average of 258 lbs. Forty lbs. of calcium arsenate dust was the average amount needed for each acre per season, the average annual cost of the dusting operation having been approximately $7.25 per acre.

Calcium arsenate dust reduced the infestation when applied to either wet or dry foliage. It is concluded that boll weevil control is profitable only when the infestation exceeds 10 per cent and when the potential yield is one-half bale or more per acre.

Topping corn does not control corn borer, C. B. DIBBLE and A. R. MARSTON (*Michigan Sta. Quart. Bul., 11 (1929), No. 4, pp. 195–197, fig. 1*).—The experiments briefly reported showed that topping decreased the yield of corn. While the number of borers may be reduced by topping, the decrease in the borer population and the damage averted do not, at present, compensate for the loss due to the cost of topping and the resulting decrease in yield.

The behavior of the corn borer in stored corn, J. B. POLIVKA and E. A. HERR (*Ohio Sta. Bimo. Bul. 138 (1929), pp. 103–105*).—It was found in a study of the borer population of 50 cribs in the heavily infested areas in 1927 that an average per farm of 200 bu. of corn, carried over during the moth flight period of this pest, at least in the Bono district of east Lucas County, had a total population of approximately 400 borers ready for reinfestation. The moth emergence period in stored corn was much extended, as compared with the normal emergence period. Moths from dry storage material began emerging in the fore part of July and continued slowly throughout July, August, and September, whereas the normal emergence period was over by July 14. Approximately one-half of the borers in crib corn failed to become moths. From the viewpoint of damage to the corn crop, the progeny of the moths which do emerge late is considered of negligible consequence.

It is pointed out that where ear corn is kept dry the borers contained therein are not an important source of reinfestation in Ohio. This also applies to borers overwintering in barn-stored fodder.

The plum curculio in apples in Massachusetts, W. D. WHITCOMB (*Massachusetts Sta. Bul. 249 (1929), pp. 25–52, pl. 1, figs. 7*).—This is a report of studies of the life history, habits, and control of the plum curculio on apples. It is concluded that plums are preferred as food, but only slightly more than apples, and that all stone and pomaceous fruits may be attacked. The pest is at the present time the most injurious enemy of apples in the State. The varieties Duchess, Yellow Transparent, and Gravenstein, which blossom early or develop rapidly after the petals fall, are more severely injured in the spring than late developing sorts, such as Northern Spy and McIntosh. In confinement the beetles made an average of 236 feeding punctures per pair, and feeding punctures constituted from 64 to 83 per cent of the total number of punctures.

A pictorial diagram is given of the seasonal history of the curculio. The first overwintering beetles appear when the blossom buds are showing pink,

and the largest number enter the trees between June 10 and 30. The first eggs are laid about June 1, and the number deposited increases steadily to a maximum between June 21 and 30. Oviposition ceases about August 1. Feeding by overwintering beetles begins and reaches the maximum about the same time as oviposition, but it continues in decreasing amounts until cold weather. Larvae leave the fruit first about June 30, in greatest numbers between July 10 and 20, and cease before September 1. Beetles emerge from the soil from late July to early October, reaching a maximum between August 6 and 20.

The picking up of dropped apples not later than 10 days after they fall and burying them with quicklime, boiling, burning, or feeding them to livestock is the most effective cultural operation in combating the pest.

The calyx spray, the 7-day spray, and the 3-week spray are the most important for combating the plum curculio in apples. Of these, the 7-day or first curculio application is the most effective. Powdered lead arsenate, 2 lbs. in each 50 gal. of spray, is recommended in a spray schedule to combat the plum curculio. There is little danger of excessive arsenical residue following the recommended spray schedule.

The large citrus borer of south India, Chelidonium cinctum (Guer.), K. KUNHI KANNAN (*Mysore Dept. Agr., Ent. Ser. Bul. 8 (1928), pp. 24, pls. 3, figs. 10*).—This is an account of a serious pest of orange, lime, citron, and pomelo in south India.

Aphodius granarius (Coleoptera), an intermediate host for Hymenolepis carioca (Cestoda), M. F. JONES (*Jour. Agr. Research [U. S.], 38 (1929), No. 11, pp. 629–632, fig. 1*).—It has been found in experiments at the U. S. D. A. Animal Husbandry Farm at Beltsville, Md., by feeding gravid segments of the tapeworm *H. carioca* to the dung beetle *A. granarius* that this beetle serves as an intermediate host. It is thought that some poultry cestodes may have more than one normal intermediate host, possibly varying with different localities and with different seasons.

Points to be emphasized in general sanitation for the control of *H. carioca* are prompt and efficient disposal of droppings, so far as possible, and keeping the yards free from unnecessary boards and miscellaneous objects that serve as temporary hiding places for beetles. If screening is resorted to, it is important that the mesh be fine enough to exclude small beetles as well as larger insects. Specimens of *A. granarius* vary from 4 to 6 mm. in length and from approximately 1.5 to 3 mm. in width. Smaller specimens have been observed to pass through a 2-mm. opening easily, so that, according to present knowledge, only screening with a mesh of about 1.5 mm. as a maximum size prevents infection by the exclusion of the intermediate hosts already known.

Report of the Dominion apiarist, C. B. GOODERHAM (*Canada Expt. Farms, Bee Div. Rpt. 1927, pp. 22, figs. 5*).—This is a general report upon the activities of the year. Following general notes it deals with honey production at Ottawa and at the out-apiary, bees and pollination, queen breeding, wintering two queens in one hive, Carniolan v. Italian bees, egg-laying capacity of queens, package bees as a means of strengthening weak colonies in the spring, hives, an experiment to determine the field force of a colony, disease, wintering, honey inspection, and grading, and experiments on fermentation and granulation in honey.

Forty-eighth annual report of the Beekeepers' Association of the Province of Ontario, 1927 (*Ontario Dept. Agr., Beekeepers' Assoc. Ann. Rpt., 48 (1927), pp. 132*).—This is a report of the forty-eighth annual meeting of the association held in Toronto in November, 1927.

The campaign against bee disease in German Switzerland, F. LEUENBERGER (*Bee World, 10 (1929), No. 1, pp. 9–12*).—This contribution deals with

control work with foulbrood, including foulbrood insurance, acarine disease, and nosema in Switzerland.

Description of a new species of Coccophagus recently introduced into California, H. Compere (*Calif. Univ. Pubs. Ent., 5 (1929), No. 1, pp. 3, figs. 2*).—Under the name *C. gurneyi* n. sp. the author describes a hymenopterous parasite recently introduced into California from New South Wales to aid in controlling the citrophilus mealybug (*Pseudococcus gahani* Green). The parasite is said to be rapidly becoming abundant in certain orchards of Orange and Los Angeles Counties, where it was first colonized.

A new variety of Tarsonemus (Acarina) from the Pacific Coast, H. E. Ewing (*Ent. Soc. Wash. Proc., 31 (1929), No. 2, pp. 31, 32*).—The name *T. approximatus* Banks var. *narcissi* is given to a new variety found infesting narcissus plants and bulbs at San Leandro and Natividad, Calif., and Bellingham, Wash., causing some injury by penetrating between the fleshy scales.

The feather mite in Ohio, also known as the tropical fowl mite, with notes on a valuable aid in its control, C. R. Cutright (*Ohio Sta. Bimo. Bul. 138 (1929), pp. 100–102, fig. 1*).—Attention is called to the occurrence of this mite in Ohio, where it came to the notice of the station in January, 1929. The pest was destroyed by painting the perches with nicotine sulfate about one-half hour before the fowls went to roost. It is recommended that the application of nicotine be repeated after about seven days in order that any newly hatched mites may be destroyed. In addition to the use of nicotine each bird should be treated individually, either dusting it with finely ground sulfur or flowers of sulfur, or dipping in a solution made according to the following formula: Soap (any brand) 1 oz., flowers of sulfur 2 oz., and water 1 gal.

ANIMAL PRODUCTION

[Animal nutrition studies at the Ohio Station] (*Ohio Sta. Bul. 431 (1929), pp. 117, 118, 119*).—Results of five studies are noted.

Vitamin-A content of alfalfa hay, R. M. Bethke and C. H. Kick.—Alfalfa hay exposed to sun, rain, or dew for several days showed a marked loss in vitamin A as determined with rats, but storing dried alfalfa for one year either ground or unground did not materially affect its vitamin A content.

Vitamin A in stored yellow corn, C. H. Kick and R. M. Bethke.—Preliminary results indicate little deterioration in the vitamin A content of yellow corn stored for one year either whole, cracked, or finely ground.

Calcium and phosphorus in bone formation in the pig, R. M. Bethke, B. H. Edgington, and C. H. Kick.—In this study with pigs, it was found that the proportion of calcium and phosphorus is of greater significance in calcification than the amount of the respective elements in the rotation. The most favorable calcium and phosphorus ratio was found to lie between 1:1 and 2:1, and the need for the antirachitic factor was at a minimum at this ratio.

Calcium-phosphorus ratio in nutrition of the chick, R. M. Bethke, D. C. Kennard, C. H. Kick, and G. Zinzalian.—With chicks the most favorable calcium and phosphorus ratio for growth and bone development was found to lie between 3:1 and 4:1. When it exceeded the latter ratio, growth decreased and the vitamin D requirements increased.

The complex nature of vitamin B, C. H. Hunt.—When the antineuritic and antipellagric vitamins were isolated from yeast and fed to rats their rate of growth was not comparable to that produced by the original yeast or by a water extract of the yeast, but when the yeast residue was fed in conjunction with the vitamins excellent growth was obtained. This indicates that a third

factor is associated with the vitamin B of yeast, but at the present time it is not known whether it is a vitamin or an associated protein.

In studying the occurrence of the above vitamins in natural foods it was found that the antineuritic factor is more highly concentrated in wheat and corn than the antipellagric, while the latter is more highly concentrated in milk than the former. Soybean leaves have a higher concentration of the antipellagric than of the antineuritic factor, while the reverse is true of the seeds and pods.

United States Animal Husbandry Experiment Farm, Beltsville, Md., E. W. SHEETS and B. F. BRANDON (*U. S. Dept. Agr. Misc. Pub. 34 (1929), pp. II+14, figs. 11*).—A publication of popular nature intended principally for the use and guidance of visitors at the Beltsville farm contains a map of the principal buildings and a brief summary of experiments in progress at the farm with beef cattle, swine, sheep, milk goats, poultry, and small laboratory animals.

[Experiments with beef cattle at the Ohio Station] (*Ohio Sta. Bul. 431 (1929), pp. 110, 111*).—Several experiments are briefly noted.

Chopping v. grinding roughage.—Chopping roughage into 0.5-in. lengths increased the gains of steer calves over a 236-day feeding period, but grinding the roughage gave less desirable results.

Mixed v. unmixed chopped roughage and grain.—Grain and chopped roughage mixed before feeding was compared with the two fed separately during a 147-day feeding period. The gains were practically the same in both lots, but in this study the cattle fed the mixed grain and roughage had a higher market value.

Shelled v. ground shelled corn.—Cattle averaging 700 lbs. per head made more efficient gains when full fed shelled corn over a 77-day feeding period than those fed ground corn.

Corn-and-cob meal v. shelled corn.—More efficient but less rapid gains were obtained when corn-and-cob meal was fed than when shelled corn was fed to calves, but the latter calves had a higher market value.

Pasture vs. silage and hay, G. Bohstedt, D. S. Bell, and P. Gerlaugh.—On a full feed of corn and linseed meal on bluegrass pasture, cattle gained more rapidly than those on the same concentrates in dry lot. The dry lot cattle had a higher market value than the pasture cattle, but not enough more to overcome the increased efficiency of pasture.

Steer feeding on pasture vs. feeding in dry lot, P. GERLAUGH (*Ohio Sta. Bimo. Bul. 138 (1929), pp. 87–89*).—Steers averaging aproximately 662 lbs. per head that had been fed in identical manner during the winter were divided into 2 lots of 9 head each on June 5 and fed to October 30. One lot received ground shelled corn and linseed meal on bluegrass pasture, while the other lot was fed ground shelled corn, linseed meal, corn silage, and mixed hay in dry lot.

The average daily gain for the steers in dry lot was 1.88 lbs. and for those on pasture 2.36 lbs. per head during the 147-day period. The dry lot cattle showed more finish than the pasture cattle until the last few weeks of the test, indicating that the latter cattle grew more than those in dry lot. The shrink in shipping was 4.4 per cent for the pasture-fed cattle and 1.8 per cent for the dry-lot cattle. The latter lot sold for 25 cts. per hundredweight more and dressed 1.13 per cent more than the pasture cattle. However, due to the fact that the gains on pasture cost less than those in dry lot, the profit per steer was greater for the pasture-fed cattle when the pork credit for the dry-lot cattle was omitted.

Steer-feeding experiments in the sugar-cane belt, J. R. QUESENBERRY (*U. S. Dept. Agr. Circ. 65 (1929), pp. 16*).—The results of 8 years' work in comparing various silages (E. S. R., 53, p. 271) and combinations of these crops with soybeans, various quantities and combinations of cottonseed meal, molasses,

rice bran, rice polish, and brewers' rice with the silages, and molasses, rice bran, rice polish, and brewers' rice as supplements to silage and cottonseed meal for fattening steers at the Iberia Livestock Experiment Farm, Louisiana, are reported in this publication. The silages compared were corn, sorgo, Japanese cane, sugarcane, and shallu. A summary of the data for each year of the experiment is reported separately, but since no one year's results are conclusive a summary and conclusions for all are given.

All of the crops tried as silages and the combinations of these with soybeans gave good results for fattening steers under the conditions of the study. Corn silage full fed with 4.4 lbs. of cottonseed meal and 5.1 lbs. of either molasses or rice polish produced 22 per cent greater daily gains than when sorgo silage replaced the corn silage. When corn silage and cottonseed meal were fed as above with 4.1 lbs. of molasses, 8 per cent greater gains were produced than when a silage composed of two-thirds corn and one-third soybeans was fed in place of corn silage. A ration of corn and soybean silage full fed, 3.9 lbs. of cottonseed meal, and 5.6 lbs. of either molasses or rice bran produced 18 and 25 per cent greater gains, respectively, than rations in which sorgo and soybean or Japanese cane and soybean silage replaced the corn and soybean silage.

The various combinations of molasses, rice bran, rice polish, and brewers' rice with silage and cottonseed meal proved satisfactory. The gains made with cottonseed meal alone and with cottonseed meal supplemented with molasses, rice polish, or brewers' rice were practically the same. Rice bran produced markedly less gain than cottonseed meal alone or cottonseed meal supplemented with molasses, rice polish, or brewers' rice when fed with silage. Adding 2.3 lbs. of molasses to a ration of silage and 6.5 lbs. of cottonseed meal produced no beneficial results.

[Experiments with sheep at the Ohio Station] (*Ohio Sta. Bul. 431 (1929), pp. 113, 114, 123, fig. 1*).—Two experiments are noted.

Sweet clover pasture for sheep, D. S. Bell.—A 2-acre plat of sweetclover with a medium to good stand furnished 81 days of grazing for 51 head of yearling ewes receiving 0.5 lb. of grain per head daily in addition to the pasture. While the ewes lost some weight on pasture due to their high condition at the time they were turned out, they remained thrifty and vigorous.

Dehorning Merino ram lambs, B. L. Warwick.—Preliminary results indicate that the application of caustic to the horn buds of newborn lambs is a satisfactory method of preventing horn growth. The following points should be observed in this operation: (1) The animal must not be more than a few days old, (2) the hair and wool must be clipped close over the horn and surrounding area, which should be ringed with vaseline, (3) the clipped area scraped and moistened before the caustic pencil is applied, and (4) the caustic application repeated about a week after the first application.

Trials in finishing western lambs reported, G. A. Brown and G. A. Branaman (*Michigan Sta. Quart. Bul., 11 (1929), No. 4, pp. 175–177*).—Western lambs averaging approximately 66 lbs. per head were divided into 7 lots of 15 head each and fed for 80 days to compare the economy of various rations. All lots received alfalfa hay. Lots 1 to 4, inclusive, were fed shelled corn, lot 6 barley, and lot 7 oats. Lots 2, 3, 4, 6, and 7 received corn silage; lots 3, 4, and 5 linseed meal; lot 4 corn stover; and lot 5 shock corn.

The average daily gains in the respective lots were 0.29, 0.29, 0.37, 0.34, 0.33, 0.34, and 0.33 lb. per head. The cost of feed per 100 lbs. of gain was highest in lot 2, followed in descending order by lots 5, 1, 7, 4, 6, and 3. Adding corn silage to the ration in lot 2 reduced slightly the rate of gain, increased materially the cost of gain, and decreased the profit per head as compared to lot 1. However, when linseed meal was added to the corn, alfalfa,

and silage ration as in lot 3, there was a material increase in rate and decrease in cost of gains and the profit per lamb was highest in this lot. Substituting corn stover for two-thirds of the alfalfa hay in lot 4 as compared with the ration fed lot 3 reduced the rate of gain, increased the cost, and reduced the return per lamb, but still returned a fair profit over the feed cost. When shock corn was substituted in lot 5 for the shelled corn and silage fed lot 3, the gains were smaller, the feed cost per hundredweight higher, and the return per lamb smaller. The lambs receiving barley and oats gained more rapidly at a lower feed cost and returned a greater profit per lamb than when shelled corn was fed with the same roughages as received by lot 2. Barley produced slightly larger gains and returned slightly more profit per lamb than did oats.

[Experiments with swine at the Michigan Station], G. A. Brown (*Michigan Sta. Rpt. 1927, pp. 266–270, 273, 274*).—Results of three experiments are noted.

Alfalfa and rape pasture for growing and fattening pigs.—In this study 3 lots of 15 pigs each averaging approximately 41 lbs. and 3 lots of 15 pigs each averaging approximately 35 lbs. per head were fed to an average final weight of 215 lbs. on alfalfa and rape pasture, respectively. The grain rations were the same as those previously noted (E. S. R., 59, p. 463). A 1-acre pasture was furnished each lot, and in addition to the forage available lots 1 to 3 produced 3,115, 2,800, and 3,355 lbs. of hay, respectively.

The average daily gains in the respective lots were 1.44, 1.23, 1.29, 1.24, 1.18, and 1.11 lbs. per head. The ration of shelled corn, protein supplement, and minerals on alfalfa pasture produced somewhat larger and more economical gains than when fed with rape pasture. It was also more efficient and economical than a ration of ground barley, protein supplement, and minerals when fed on rape pastnre. Limiting the grain ration reduced the efficiency but not the economy of gains. Ground barley, ground oats, and minerals with alfalfa pasture prodnced appreciably smaller gains and required more feed per unit of gain than the corn, protein, and mineral ration. However, the ground barley-ground oats ration on alfalfa pasture made larger gains and required 4.64 per cent less concentrates per unit of gain than the same ration on rape pasture. When ground oats were fed with barley 158 lbs. replaced 87 lbs. of barley and 17.38 lbs. each of tankage and linseed meal in a ration of ground barley, protein supplement, and minerals on rape pasture.

Cull beans for fattening pigs.—This study has been continued (E. S. R., 59, p. 463) using 6 lots of 8 pigs each, averaging approximately 105 lbs. per head and fed in the same manner as previously except that the sixth lot received cull beans, minerals, and alfalfa hay. The average daily gains in the respective lots were 1.61, 1.25, 1.01, 1.13, 1.12, and 0.78 lbs. per head. It required 61, 76, 95, 85, and 85 days for the first 5 respective lots to reach an average final weight of 201 lbs., while the sixth lot was below this point at 100 days.

The ground corn and tankage ration produced the largest gains and required less concentrates than any of the other rations. Cull beans fed in place of tankage produced satisfactory gains with but a slight increase in food consumption per unit of gain. When fed ground corn they produced 24.01 per cent greater daily gains and required 9.09 per cent less feed per unit of gain than when fed ear corn. The proportion of cull beans fed up to two-thirds of the ration had little influence on the daily gains, but when cull beans were fed alone a small daily gain was obtained at a considerable increase in feed requirements. The cost of feed gradually decreased as the proportion of cull beans increased, but no account was made of the cost of cooking and the labor involved in feeding the beans.

Community hog house v. portable cot as shelter for growing and fattening fall pigs.—Two groups of 8 pigs each averaging approximately 50 lbs. per head were fed in the same manner, but group 1 was housed in a community hog house with access to an outside paved lot, while the second group was housed in a gable roof portable hog house. It required 128 days for the pigs in group 1 and 107 days for group 2 to reach an approximate weight of 200 lbs. The average daily gains were 1.17 and 1.41 lbs. per head in the respective groups. Group 2 also required 43.69 lbs. less feed to produce 100 lbs. of gain than did group 1. One pig in the community house showed unmistakable signs of rickets, while 2 others showed symptoms of the same disease. These setbacks in group 1 undoubtedly affected the rate and economy of their gains.

Swine type studies, I–III (*Illinois Sta. Buls. 321 (1929), pp. 339–392, figs. 6; 322 (1929), pp. 395–490, figs. 21; 323 (1929), pp. 491–600, figs. 6*).—This study is in three parts.

I. *Type in swine as related to rate and economy of gain*, W. E. Carroll, S. Bull, J. B. Rice, R. J. Laible, and R. A. Smith.—Concluding this study, the details of which have been previously noted (E. S. R., 56, p. 264), the gains and feed records of individual pigs are presented, except in the case of group feeding, in which case the feed consumption of the group is given.

Statistical analysis of the data showed no significant differences in the rate or economy of gains of any of the lots, with the possible exception of the chuffy type, which was somewhat inferior in these respects to other types. It was concluded that type is not a controlling factor in either rate or economy of gain in swine.

II. *Type in swine as related to quality of pork*, S. Bull and J. H. Longwell.—Over a period of three years carcasses and cuts of 189 hogs slaughtered at 175, 225, and 275 lbs. were studied from the standpoint of the desirability of the pork produced.

The very chuffy type hogs dressed higher when slaughtered at 175 lbs. than the intermediate and rangy types, but at the other weights there were no significant differences in dressing percentages. Carcass measurements showed that length of carcass, of head and neck, and of legs varied with type, being shortest in the very chuffy type and longest in the very rangy type. Type had little or no effect upon the depth of chest, and the length of body proper apparently varied more with individuals than with type.

When hand fed the feet and picnics of the rangy type made up a larger percentage of the carcass than in the case of other types similarly fed, and this type also had a lower percentage of fat cuts. The same was true of very rangy carcasses as compared with intermediate carcasses when the animals were self-fed, but there was little difference in the cutting percentages of the chuffy, intermediate, and rangy types when self-fed in dry lot. The percentage of lean in the carcasses of hand-fed hogs was less in the very chuffy type and somewhat higher in the very rangy type than in the other types. When self-fed there was no difference in the amount of fat on the chuffy, intermediate, and rangy carcasses, but the very rangy carried materially less fat. The very rangy carcasses had a higher percentage of skin and bone than the other types. When hand fed, the very chuffy and chuffy types contained less skin and the rangy type more than the intermediate type, and the percentage of bone was lower in the very chuffy and higher in the rangy carcasses than in the chuffy and intermediate carcasses. However, the differences were not so marked when the animals were self-fed as when hand fed.

Very chuffy hogs were finished before reaching a market weight of 225 lbs. when hand fed, while most of the rangy hogs were not finished at this weight. When self-fed to 225 lbs., some of the chuffy hogs were overdone, the rangy

hogs were usually finished, but the very rangy types were too rough. At this weight many of the bellies of the very chuffy and some of those of the chuffy type were too fat, regardless of whether the animals were hand fed or self-fed, while the bellies of the rangy and very rangy types were unfinished and lacking in quality. The hams of the very chuffy and chuffy types had short shanks and good shape, but many were too fat, while those of the rangy and very rangy types were too long in the shank and had too high a percentage of bone. Except in the very rangy type the picnics were of good grade. However, the shanks of the rangy type were longer than those of the other types. With the other cuts, the type of hog did not materially affect their quality.

These results indicate that the intermediate type is the most desirable from the butcher's standpoint, and that the rangy type if self-fed is usually acceptable.

III. *The energy and protein requirements of growing swine and the utilization of feed energy in growth*, H. H. Mitchell and T. S. Hamilton.—In this part of the study data were obtained on the composition of growing and fattening pigs at different weights, their maintenance requirements, the rate at which the various nutrients are deposited in the carcasses during growth and fattening, and the relation between feed consumed above maintenance requirements and the nutrients recovered in the gains. To obtain this information 30 pigs were individually analyzed at the initial weights of 55 to 70 lbs., 12 pigs at 175 lbs., 63 at 225 lbs., and 10 at 275 lbs. Maintenance feeding trials were conducted with 30 pigs at the initial weights and with 27 at 225 lbs. or more, and 42 of these pigs were killed and analyzed at the end of the maintenance feeding. Digestion and metabolism trials were also conducted with 23 pigs, some of which were on maintenance feed and some on full feed.

Although there were great differences in the market finish of the various types, the carcass analyses showed only slight differences, indicating that the distribution and not the content of fat was the deciding factor in judging for market finish. At heavier weights the intermediate-type pigs were more economical of food energy in maintenance, but no type differences were detected in feed utilization. With the ration used it required approximately 1 lb. per day per 100 lbs. of live weight for maintenance whether the animals weighed from 50 to 70 lbs. or 225 lbs. or more.

The changes in composition, particularly in young pigs, on a maintenance ration consisted of a withdrawal of fat and a corresponding storage of water, protein, and ash. During a 110-day feeding period on a maintenance ration the average decrease in the energy content of the body was 31 per cent for chuffy, 28 per cent for intermediate, and 16 per cent for rangy type pigs. At 225 lbs. the average losses of body energy were 21, 0.5, and 15 per cent, respectively, on a maintenance ration. On this basis it seems necessary to provide about 1.5 lbs. of the ration per 100 lbs. of live weight to maintain energy equilibrium for the young pigs and approximately 1 lb. for pigs 225 lbs. or more. The metabolizable energy of the ration fed per kilogram of dry matter averaged 3.347 therms for fat pigs on full feed, 3.44 therms for fat pigs on maintenance, and 3.287 therms for young pigs on maintenance, and this is not appreciably affected by the level of feeding or by changes in the proportions of individual feeds. The metabolizable energy, expressed in percentage of gross energy, averaged 78, 79.4, and 73.2 per cent, respectively, for these groups of pigs.

After attaining a weight of from 150 to 175 lbs. the protoplasmic composition of pigs remained practically constant and was unaffected by the manner of feeding. This mature composition consisted of from 75 to 76 per cent of water, 20 to 21 per cent of crude protein, and approximately 4 per cent of ash. There was no appreciable difference in the composition of sow and barrow carcasses at 225 lbs., nor was the composition appreciably affected by variations

in the rate of gain ranging from 0.75 to 1.25 lbs. per day if the manner of feeding remained the same. Pigs in gaining weight from 65 to 225 lbs. deposited 74 per cent of the added dry matter, 58 per cent of the added protein, 15 per cent of the added ash, and 78 per cent of the added energy in the boneless meat of the dressed carcass. Of the added ash 80 per cent was stored in the skeleton, and approximately 50 per cent of the added protein and 24 per cent of the added energy was stored in the lean meat.

Based on certain simplifying assumptions it was computed that the net energy value of the rations used for growth and fattening averaged 89.5 therms per 100 lbs. of live weight in one experiment and 74.8 therms in another experiment.

A type index based on the percentage of the volume of a box, the dimensions of which were determined by the maximum length, height, and width of the pig was chosen as a measure of type. This index was larger for the chuffier type of pig, and for pigs of the same type it was larger for the fatter pigs. The data also led to the formulation of tentative estimates of the food requirements of pigs at different ages and weights.

Alfalfa pasture proves valuable for pigs, W. E. J. EDWARDS (*Michigan Sta. Quart. Bul., 11 (1929), No. 4, pp. 184–187*).—For three years studies have been conducted to compare the rate and cost of gains of spring pigs fattening on alfalfa pasture with similar pigs fed the same feeds in dry lot. Each lot was self-fed yellow corn and a protein supplement composed of equal parts of tankage and linseed meal. The dry-lot pigs had access to alfalfa hay racks, and both lots had access to a mineral mixture consisting of 45 lbs. of bone meal, 20 lbs. of pulverized limestone, and 30 lbs. of common salt. In each test 15 pigs were fed on 1 acre of alfalfa, which also yielded an average of 2,735 lbs. of hay in addition to the forage, and 10 pigs were fed in dry lot.

The difference in the daily gains of the 2 lots for the three years was not significant. The pigs in dry lot consumed but little hay and less corn per hundredweight gained but larger amounts of protein supplement than those on pasture. The high-priced protein feed increased the cost of gains over the cost for the pasture pigs. When the hay cut from the alfalfa pasture was valued at $7 per ton and the lower cost of production was credited, alfalfa pasture in this study had a feed value of $27.87 per acre.

Correcting the inefficiency of peanuts for growth in pigs, O. G. HANKINS and J. H. ZELLER (*U. S. Dept. Agr., Tech. Bul. 110 (1929), pp. 12, fig. 1*).—A series of three experiments was conducted at the Animal Husbandry Experiment Farm, Beltsville, Md., to determine whether the addition of a protein supplement to a peanut ration for growing pigs would tend to increase the efficiency of the ration. Fall pigs were placed on experiment soon after weaning during the years 1924, 1925, and 1926. One lot of pigs each year was self-fed peanuts and a mineral mixture, while another received the same ration with the addition of tankage.

It was found that pigs receiving no protein supplement made average daily gains of 0.4 lb. per head as compared with 0.89 lb. for those receiving tankage. Tankage also stimulated the appetites, as indicated by the lots receiving tankage, which consumed an average of 0.38 lb. of tankage and 0.1 lb. more of peanuts (shelled basis) per head daily than the lots receiving no tankage. In the lots in which supplement was fed it required 276 lbs. of peanuts (unshelled) and 42 lbs. of tankage to produce 100 lbs. of gain, while in the other lot it required 585 lbs. of peanuts for the same gain. The minerals consumed were not included in the calculations.

The animals consumed an average of 25.49 lbs. of tankage protein per 100 lbs. of gain, which proved equal to 61.57 lbs. of peanut protein consumed in the lots

receiving no tankage. Since the tankage furnished but small amounts of carbohydrates and fat, the results indicate that tankage protein was quite efficient and largely responsible for the better results obtained in the tankage lots.

[Experiments with poultry at the Ohio Station] (*Ohio Sta. Bul. 431 (1929), pp. 118, 119, 124*).—The results of two experiments are noted.

Nutritional factors affecting hatchability of eggs, R. M. Bethke and D. C. Kennard.—Continuing this study (E. S. R., 59, p. 263) it was found that no material improvement in hatchability resulted when a ration containing meat scraps was fed unless alfalfa meal was added or milk substituted for the meat scraps. Feeding both milk and alfalfa leaf meal in the presence of vitamin D increased hatchability.

Oats for laying hens, D. C. Kennard.—Preliminary results in this study (E. S. R., 58, p. 669) indicated that the ration was improved when 20 per cent of corn was replaced with a like amount of oats. From 16 to 28 more eggs per bird were laid when the oats ration was fed. Feeding whole oats mixed with the all-mash mixture was the easiest and least expensive way of feeding this grain, although a few more eggs were secured when finely ground oats were fed. The difference did not pay for the cost of grinding. The time and trouble required for germinating oats did not seem justified by the results obtained.

[Experiments with swine at the Ohio Station], W. L. Robison (*Ohio Sta. Bul. 431 (1929), pp. 115–117, fig. 1*).—Several experiments are briefly noted.

Forage crops for pigs.—The average daily gain per pig on red clover, dwarf Essex rape, and alsike clover forage was 0.97, 0.87, and 0.73 lb., respectively, and 335, 372, and 438 lbs. of concentrates per 100 lbs. of gain were required over an eight-week period. All of the green feed in the alsike plat was consumed by the end of the period. During the latter part of the grazing season the gains were practically the same in all lots due to the short growth of the clover.

Soybeans for fattening pigs.—Continuing this study (E. S. R., 59, p. 261) with soybeans grown in corn for hogging down, no differences in the palatibility of Manchu, Midwest, Ebony, and Wilson varieties were noted. The consumption of beans to corn for 6 pigs having access to the four varieties in dry lot ranged from 1:107 to 1:2.1. There was no consistency in the consumption of the various varieties by the different pigs or by the same pigs at different times.

Cooked soybeans and soybean oil meal were superior to ground beans and compared favorably with tankage as supplements to corn for pigs in dry lot. Pigs receiving cooked soybeans and limited to the amount eaten by pigs receiving raw beans reached 200 lbs. in weight four weeks earlier and required 132 lbs. less feed per 100 lbs. of gain than the latter lot.

[*Minerals for feeding with corn*].—Adding bone meal to a mineral supplement of salt and limestone proved of little value for fall pigs fed corn, tankage, and linseed meal, but the addition of iron oxide brought about a marked improvement. Pigs fed this latter ration gained more rapidly and economically than those fed corn, salt, and a trio mixture of tankage, linseed meal, and ground alfalfa. Adding the above mineral mixture to the corn, salt, and trio mixture ration increased the rate and economy of gains. Using linseed meal but no alfalfa failed to improve the ration, while cottonseed meal was practically as good as linseed meal in the trio mixture.

Effect of type and of different grains on cost and value of pork.—Yorkshires on a ration of corn, barley, and oats supplemented with the trio mixture and minerals gained more rapidly and economically than Duroc-Jerseys when both were confined indoors. Barley was practically equal in feeding value to corn,

but because of the cost was not as economical. When ground oats were fed along with corn and supplement more rapid and economical gains were obtained than when corn was fed as the sole grain. Hulled oats was an efficient but uneconomical feed due to its high cost.

Pigs fed oats had a marked tendency to grow rather than fatten, and the same tendency was manifested in the barley lots to a lesser degree. Corn, barley, and oats ranked in the order named in their effect on the value of the corresponding cuts of meat at the same price per pound. Pigs fed a ration high in fiber were less valuable and shrank more in shipping than those on a low fiber diet. There are indications that the lean cuts of hogs fed barley or oats had a higher percentage of lean meat than of those fed corn.

Feeding poultry for egg production, C. W. KNOX (*Iowa Sta. Circ. 114 (1929), pp. 15, figs. 5*).—A popular publication describing the most approved methods of feeding poultry, with brief accounts of the value of various feeds and combinations of feeds.

Culling poultry, L. F. PAYNE and H. H. STEUP (*Kansas Sta. Circ. 147 (1929), pp. 51, figs. 30*).—Part 1 of this publication entitled Body Characters and Their Relation to Culling, by Payne (pp. 2–33), is a revision of work previously noted (E. S. R., 47, p. 577). Part 2 under the title Head Characters and Their Relation to Culling, by Steup (pp. 34–48), deals with newer developments in culling which are interpreted by means of head characteristics.

A simple linebreeding program for poultry breeders, C. W. KNOX (*Iowa Sta. Bul. 258 (1929), pp. 209–224, figs. 13*).—The author points out the advantages of line breeding for improving the flocks of the average farm poultry man. The selection of breeding birds, how to follow this system of breeding, and methods of identifying birds are described.

Cost of egg production, O. S. WILLHAM (*[Oklahoma] Panhandle Sta., Panhandle Bul. 6 (1929), pp. 12–14*).—Based on the records of the second Panhandle Agricultural College egg-laying contest, the author has calculated the feed cost of producing eggs for that section of the country as 11.28 cts. per dozen.

DAIRY FARMING—DAIRYING

[Experiments with dairy cattle at the Michigan Station], O. E. REED (*Michigan Sta. Rpt. 1927, pp. 275–277*).—Two experiments are noted.

Testing the feeding value of different mineral feeds.—At 42 months of age there was still no marked difference in the body development of the alfalfa check group and the group receiving bone flour (E. S. R., 59, p. 466). Both these groups surpassed the timothy check group and the pasture group receiving no mineral supplement. The group on a low calcium and phosphorus ration supplemented with pasture was practically equal to the timothy check group. The group receiving the basal ration plus raw rock phosphate and limestone rock, equal parts, was still inferior to the group receiving the basal ration alone, and their teeth were faulty and sensitive to cold water. The group receiving the complex mineral mixture was also inferior to the group on the basal ration.

In the alfalfa, timothy, bone flour, and pasture groups the milk production was practically the same, but the raw rock phosphate and complex mineral groups were far below the other group in this respect. The first-named groups were about 90 per cent efficient, the pasture and raw rock phosphate groups about 80 per cent efficient, and the complex mineral group about 30 per cent efficient in reproduction. Results obtained in calcium and phosphorus balance studies with the alfalfa and timothy checks and the bone flour groups indicate

that the animals utilize calcium while on a low-calcium ration more efficiently than was formerly believed. A group of 5 heifers fed timothy hay to which was added calcium showed no better development at 15 months of age than those receiving the hay alone. All these results indicate that the importance of adding minerals to the ration of dairy cows has been overemphasized.

Feeding concentrates alone to ruminants.—Continuing this study (E. S. R., 60, p. 70), it was found that the addition of crude fiber in the form of corncobs, oat hulls, or shavings did not take the place of hay or grass. Calves fed concentrates alone died with symptoms of tetany. The addition of wheat straw or corn silage prevented the tetany symptoms, but did not furnish the factor necessary for normal reproduction. A lot of 5 heifers fed a good grain mixture, silage, and timothy hay reproduced 100 per cent, while a lot of 6 heifers on the same ration, except that wheat straw replaced the timothy, did not reproduce normally in any instance.

[Experiments with dairy cattle at the Ohio Station] (*Ohio Sta. Bul. 431 (1929), pp. 100–102, 106–109, 144, fig. 1*).—The results of several experiments are noted.

Protein in the dairy ration, A. E. Perkins and C. C. Hayden.—A group of 4 cows was fed a ration of alfalfa hay, corn silage, and a grain mixture containing 40 per cent of digestible protein and compared with a group of 3 cows receiving the same ration except that the grain mixture was supplemented with molasses and contained only 6.75 per cent of protein. The whole of the first ration contained approximately 20 per cent and of the second ration approximately 4.2 per cent of digestible protein. Neither ration was eaten readily. The animals fell off in condition, and the milk flow was reduced. However, the chemical composition of the milk remained practically constant and its nutritive value changed but slightly.

Proteins in grains for milk cows on pasture, A. E. Perkins and C. C. Hayden.—Continuing this study (E. S. R., 59, p. 466), two groups of cows alternated by monthly periods on rations containing 12 and 20 per cent of total crude protein showed no difference in production or weight that could be attributed to the two levels of protein feeding. Another group on the low protein ration continuously throughout the pasture season was slightly better in both respects than either of the alternating groups. A second test with high and low protein rations fed to cows turned on pasture July 1 showed a difference of 2 per cent in production in favor of the high protein ration.

Mixing grains and roughages, C. C. Hayden and C. F. Monroe.—Using the double reversal method of feeding, two groups of cows were fed for 10 weeks on a grain mixture and ground hay composed of a mixture of equal parts of clover, alfalfa, and timothy ground in a hammer mill through a $\frac{7}{16}$-in. screen. In one ration the hay and grain were mixed and in the other fed separately. Neither ration was palatable, and from the condition of the feces neither was well digested. The average loss in weight per cow was practically the same in both lots. While the mixed ration was more readily eaten, the production was lowered, indicating that mixing gave no advantage in digestion.

Supplementing the deficiencies of milk, W. E. Krauss.—Since it was found that rats fed on an exclusive whole milk diet died of nutritional anemia, various iron salts such as ferrous sulfate, ferric citrate, ferric chloride, and colloidal ferric oxide were fed as supplements to whole milk at levels of 0.8 mg. of iron per day, but all were ineffective. However, when 0.16 mg. of copper sulfate and 0.4 mg. of iron were added to the milk, anemia was prevented or when anemia was severe rapid recovery was brought about. Yeast, casein, agar, starch, and a salt mixture were found beneficial in prolonging

life and delaying the onset of anemia in rats on a whole milk diet, but cod-liver oil and wheat germ oil were ineffective.

Tolerance of calves for formalin, W. E. Krauss and A. E. Perkins.—Seven calves were fed whole milk containing formalin in amounts varying from 1.5 to 4 cc. per gallon. Several calves scoured and did not grow rapidly, while others grew rapidly but were rough and unthrifty. Three calves were in fair condition when disposed of at 2 to 3 months of age, but the remainder at the end of 5 months were unthrifty, underweight, and had greatly distended abdomens.

Accuracy of composite milk samples, C. F. Monroe.—The results so far obtained in this study show that the fat tests obtained with composite samples of milk are always lower than the fresh tests, and this was especially true when the physical condition of a composite sample was poor. More accurate average tests of milk were obtained by testing fresh samples four times a month than by testing composite samples of all the milk produced four times a month.

Calf feeding, C. H. Crawford and W. E. Krauss.—At the Trumbull County Experiment Farm, 3 lots of Holstein calves fed milk in some form for 60, 90, and 120 days, respectively, were 100, 100, and 104 per cent normal based on height at withers. Weight and gain per calf averaged 98, 104, and 118 per cent normal in these groups.

Another test with 4 lots of calves showed that powdered skim milk fed dry was the cheapest and most satisfactory method when milk feeding was continued beyond 2 months. Calves so fed for 6 months gained at the rate of 1.5 lbs. per head daily as compared with 1.6 lbs for calves fed whole milk. Mixing powdered skim milk with fresh separator milk gave practically the same gains.

Producing high grade milk, J. K. Muse (*[Oklahoma] Panhandle Sta., Panhandle Bul. 5 (1929), pp. 6–9*).—The author discusses in a popular manner the four essential factors for keeping down the bacterial content of milk, namely, clean cows, small-top milking pails, clean, sterilized utensils, and prompt, efficient cooling.

High protein grains: Are they needed as a supplement to pasture for dairy cows, II? A. E. Perkins and C. C. Hayden (*Ohio Sta. Bimo. Bul. 138 (1929), pp. 89–93*).—Continuing this study, noted above, it was found that the production of fat was increased by the feeding of a grain mixture containing 20 per cent of total protein proportionately more than was milk production. Based on 4 per cent milk, when the increased production was compared with the increased cost of feed there was an approximate loss of 77 cts. per cow during the 3 months' season due to the use of the high-protein feed.

Studies of the composition of milk, O. R. Overman, F. P. Sanmann, and K. E. Wright (*Illinois Sta. Bul. 325 (1929), pp. 49–174, figs. 55*).—Three-day composite samples of milk taken at regular 5-week intervals throughout the lactation period of individual cows were analyzed for specific gravity and percentage of fat, protein, ash, total solids, lactose, and solids-not-fat. The samples were distributed among breeds of cattle as follows: 208 samples of Ayrshire milk, 321 of Guernsey milk, 268 of Holstein milk, 199 of Jersey milk, and 1,002 samples of milk from Guernsey-Holstein crossbred cows.

The analyses showed wide variations in the composition of the milk of different breeds, of any one breed, and of individual cows. The maximum percentages for all the samples of fat, protein, lactose, ash, total solids, and solids-not-fat were 3.6, 2.66, 2.54, 1.67, 1.69, and 1.65 times, respectively, that of the minimum percentages. The coefficient of correlation showed that "(1) as the percentage of fat increases the percentages of protein, ash, total solids,

and solids-not-fat, and the specific gravity tend to increase, and the percentage of lactose (except in the case of Ayrshire milk) tends to decrease; (2) as the percentage of protein increases, the percentage of lactose tends to decrease and the percentages of ash, total solids, and solids-not-fat and the specific gravity tend to increase; (3) as the percentage of lactose increases, the percentage of ash tends to decrease and the percentages of total solids and solids-not-fat and the specific gravity tend to increase; (4) as the percentage of ash increases, the percentages of total solids and solids-not-fat and the specific gravity tend to increase; (5) as the percentage of total solids increases, the percentage of solids-not-fat and the specific gravity tend to increase; (6) as the percentage of water increases, the percentages of each of the other components and the specific gravity tend to decrease; and (7) as the percentage of solids-not-fat increases, the specific gravity tends to increase."

Appended are tables giving the detailed results of the study.

Direct iodizing of milk is possible, E. D. Devereux (*Michigan Sta. Quart. Bul., 11 (1929), No. 4, pp. 193, 194*).—Preliminary results with the direct iodizing of milk indicate that colloidal iodine readily combines with milk proteins and unsaturated fatty acids. Within 20 to 30 seconds after adding enough iodine to make 100 parts per million the brown coloration disappears. Even at this concentration the taste of the milk is unaltered, nor does abnormal flavor develop as the milk ages and sours.

Essential factors in clean milk production, G. M. Trout (*Michigan Sta. Quart. Bul., 11 (1929), No. 4, pp.171–174*).—The relative importance of five factors in the production of clean milk has been studied, five trials being conducted with each of the factors.

Small top milk pails were found to exclude a large percentage of bacteria-laden dirt as compared with open top pails, and their use resulted in milk with a low bacterial count which fermented or soured naturally. When sterile utensils were used and the flanks and udders of cows were clipped and free from dirt, milk with a low bacterial count which soured normally without gas production was produced as compared with an unsatisfactory product when unsterilized utensils were used. Discarding the first three to five streams of milk from each teat reduced the initial bacterial count about 75 per cent. Tests of acid production showed that milk cooled below 50° F. permitted bacteria to grow very slowly, while when held at 70° enough acid was produced in 24 hours to sour the milk. In studying the method of cooling it was found that the surface cooler was the most rapid and efficient method. Cooling in a tank reduced the temperature to a satisfactory degree in 2 hours if stirred at 15-minute intervals. However, when not stirred the temperature was not sufficiently reduced in 2 hours' time to inhibit the rapid growth of bacteria. Air cooling was very slow and unsatisfactory.

Sterilization of dairy utensils with humidified hot air, A. W. Farrall and W. M. Regan (*California Sta. Bul. 468 (1929), pp. 13, figs. 4*).—In an effort to determine the value of humidified hot air for sterilizing dairy utensils, its operation was compared with that of two other types of known efficiency, namely, the steam boiler and the steam electric methods. A galvanized iron tank, connected with a steam boiler and fitted with a sump in which immersion type electric heaters or electric air heaters could be placed, was used for all three methods. The time and temperature relationships inside the tank, the power and energy requirements, bactericidal efficiency, moisture remaining on apparatus and utensils after sterilization, and the practicability of operation were measured in a series of tests of each of the three methods.

A temperature of 210° F. was reached in 54 minutes with the humidified hot air method, using a 9.58 kw. heater; in 51 minutes with the steam electric

method, using a 16.24 kw. steam electric type heater; and in 76.5 minutes with the steam boiler, including the time necessary to generate 80 lbs. of steam. There were slight variations in temperature with the humidified hot air, while the sterilizer was heating up. This method was the most economical in cost of energy for operation, and the steam electric method was the most expensive. The humidified hot air method left the utensils practically dry, while an appreciable amount of water was left on them when steam was used. The bacterial reduction was quite satisfactory with the hot air method. In practice this method proved a satisfactory and efficient means of sterilizing dairy utensils. The chief disadvantage of the method is that it furnishes no hot water for washing utensils.

Making cottage cheese on the farm, W. J. Caulfield (*Kansas Sta. Circ. 146 (1929), pp. 12, figs. 5*).—In this publication the author discusses two methods for the preparation of cottage cheese in the home and the care and necessary precautions that must be observed in order to produce a satisfactory product. A section on Serving Cottage Cheese, by M. M. Kramer, is included.

Preliminary report on the amount of overrun produced under reduced air pressure, F. W. Fabian (*Michigan Sta. Rpt. 1927, pp. 304–309, figs. 2*).—Ice cream mixes were placed in sealed jars equipped in such a manner that the air could be pumped out until a vacuum gage registered 29. The mix was then gently agitated until air bubbles ceased to rise to the top, allowed to stand for from 30 minutes to 2 hours, and then frozen with a vigorous agitation while still under reduced air pressure. These mixes were compared with similar mixes frozen under normal conditions.

It was found that when a mix frozen under normal conditions had an overrun of 49 per cent, under reduced air pressure the overrun was only 15.7 per cent. The overrun in all the mixes under reduced air pressure varied from −1 to 42.6 per cent. Several explanations are given of the overrun obtained under the reduced air conditions, such as the expansion of the remaining air and the supposition that the walls of interstices of violently agitated viscous mixes become firm enough during the freezing process to stand up and thus give an apparent increase in volume.

VETERINARY MEDICINE

[Report of work in animal pathology at the Michigan Station], E. T. Hallman (*Michigan Sta. Rpt. 1927, pp. 279–287, 296–298, 299–303, 311–327*).—Reference is first made to the progress of work by E. R. Carlson on diseases of the reproductive organs of the cow. Studies of the clinical aspects of puerperal diseases and sterility continued during the year by L. B. Sholl are next considered. In only one case was any organism other than *Bacterium abortus* obtained from the 15 udders examined. An account of observations of the pathology of *B. abortus* infection by Hallman, Sholl, and Delez has been noted (E. S. R., 60, p. 371). Studies of fetal and calf pneumonia, in which 17 fetuses and 6 calves were examined, show that pneumonia is of frequent occurrence associated with *B. abortus* or other infections of the genital tract during pregnancy. A brief account is given of work on the relation of *B. abortus* in cattle to human health. The work conducted by A. L. Delez upon the pathological alterations in cattle fed on variously altered diets is discussed, the histological examination of 30 cases being summarized.

The work with poultry diseases reported upon by H. J. Stafseth (pp. 299–303) includes coccidiosis, bacillary white diarrhea, sarcomatosis and leukemia, the agglutination test for bacillary white diarrhea, and the result of bacteriological and pathological examinations. The studies of coccidiosis were made in its

relation to paralysis, a preliminary report on which has been noted (E. S. R., 56, p. 878). Much additional information is said to have been obtained to support the view that duodenal coccidiosis of growing stock is the most common cause of lameness or paralysis. The small coccidia mentioned in the earlier account have since been found in specimens from typical cases of so-called range paralysis received from Ontario, New Jersey, Ohio, and Illinois in addition to many cases from Michigan. In a study of the means of transmission of coccidiosis in which a large number of sparrows were examined, it was found that over 75 per cent of the birds harbored coccidia and some showed duodenal lesions. It appears, however, that the coccidia found in sparrows differ somewhat from those found in chickens. In an examination of a number of pigeons exhibiting symptoms similar to those observed in coccidiosis of chickens, lameness and paralysis were conspicuous manifestations of the disease. In these pigeons numerous coccidia morphologically indistinguisbable from those found in chickens were observed, the duodenum being the seat of infection. Numerous whitish specks or streaks representing foci of coccidial infection were observed in the duodenal mucosa of one of the pigeons. In these lesions numerous intracellular stages of the coccidia were found.

In work on various phases of the white diarrhea problem (E. S. R., 57, p. 575; 58, p. 178), lung infection with *Salmonella pullorum* was found to be quite common in young chicks, the infected lungs usually showing numerous small grayish nodules, which some observers have considered to be caused by molds. Of 20,176 blood samples tested during the year for pullorum disease, 2,962 were positive and 16,233 negative, 115 being cloudy and 857 unfit.

The work on parasitology is reported upon by W. L. Chandler (pp. 311–327). Further studies of the vermicidal value of iodine (E. S. R., 57, p. 879) are referred to. The work with stomach worms in sheep showed that a dose of 3 oz. of a preparation consisting of a protein iodine compound bearing 2 per cent absorbed iodine and containing a metal sulfate in solution, such as magnesium, zinc, or copper sulfate, was 100 per cent efficient in the destruction of all species of worms in the fourth stomach when the dose entered this stomach, which it proved to do in 85 of 102 animals treated. The results of work with poultry have shown that it is highly improbable that it will ever be possible to utilize pills for the dosing of poultry, although the data indicate that materials consisting of iodine absorbed to a suitable absorbent neutral to iodine are entirely efficient in the destruction and removal of intestinal worms in poultry. It would also appear that colloidal iodine containing 2 per cent iodine is efficient. No evidence of inflammation or pathological lesions which could be attributed to the dose was found in any of the birds examined. The results of the dosings, check dosings, and post-mortem examinations are given in detail in tabular form.

Cooperative experiments conducted by C. M. Ferguson indicate that neither the iodizing of the eggs nor the spraying of the incubator affected the hatchability of the eggs. Colloidal iodine was found by C. F. Huffman to be effective in the treatment of all of 50 cases of dermatomycosis. He showed that the animals recovering from the Trichophyton infection did not become reinfected.

Discussion on "Ultra-microscopic viruses infecting animals and plants" (*Roy. Soc. [London] Proc., Ser. B, 104 (1929), No. B 733, pp. 537–560*).—This discussion is entered into by C. Martin, P. A. Murphy, J. A. Arkwright, J. E. Barnard, K. M. Smith, W. E. Gye, J. C. G. Ledingham, R. N. Salaman, F. W. Twort, C. H. Andrewes, S. R. Douglas, E. Hindle, W. B. Brierley, and A. E. Boycott

On the influence of temperature on the rate of agglutination of bacteria, A. Fleming (*Brit. Jour. Expt. Path., 9 (1928), No. 5, pp. 231–235*).—The

author found in agglutination tests that while the rate of union of the agglutinin with the bacterium is hastened to some extent by a rise of temperature the rate of flocculation is not affected by temperature changes between 18 and 55° C. There is, however, some delay at temperatures just above freezing point. It follows, therefore, that the increase in the rate of flocculation with increase in the temperature when agglutination tests are done in the ordinary way is due to convection currents which are set up in the fluid in the different tubes. These currents would be more marked at the higher temperatures, thus bringing the bacteria more rapidly into contact with each other and so favoring flocculation.

Tests with certain disinfectants upon the virus of foot-and-mouth disease and the fowl cholera bacillus [trans. title], R. Helm and W. Wedemann (*Arch. Wiss. u. Prakt. Tierheilk., 58 (1928), No. 1, pp. 68–94; abs. in Trop. Vet. Bul., 17 (1929), No. 1, p. 27*).—The authors found cresol-sulfuric acid, formaldehyde, caustic soda, and Sulfalyd 1 and 2 to be good disinfectants for foot-and-mouth disease. Used against the fowl cholera bacillus, caustic soda was the most effective.

Biology of Bacterium pyogenes, M. Rolle (*Biologie des Bacterium pyogenes. Inaug. Diss., Tierärztl. Hochsch., Hanover, 1928, pp. [3]+56, pls. 14*).—This account, given in connection with a list of 62 references to the literature, deals with studies of the morphology and staining; morphological and cultural differentiation; resistance to heat; pathogenicity for cattle, calves, and swine; differential diagnosis; pathogenesis; etc., of *B. pyogenes*.

Experimental observations on anthrax infection and anti-anthrax immunisation, A. M. M. Grierson (*Jour. Compar. Path. and Ther., 42 (1929), No. 1, pp. 8–24*).—It was found that a "solid" immunity to anthrax can be produced by cutaneous vaccination of animals of moderate susceptibility (rabbits), cultures attenuated by Pasteur's method being employed for the purpose.

"Cutaneous immunization is attended by less risk of fatal results than other methods. The serum of these animals does not confer protection against the most minute doses of infection in highly susceptible animals (mice). It has not been possible to immunize animals of high susceptibility (guinea pigs) by this method; these animals have invariably succumbed to either the 'first' or 'second vaccine' (after survival from the 'first'). It seems doubtful whether Besredka's claim holds good that the skin is the only tissue susceptible to *B[acillus] anthracis*. Anthrax spores may be introduced into the blood stream through the alimentary mucosa and remain latent in the blood for a certain length of time, only germinating and producing an active infection as a result of some additional factor."

The questions of local immunity and antianthrax immunity are discussed with particular reference to cutaneous vaccination.

Studies of foot-and-mouth disease (first report) [trans. title], H. Vallée and H. Carré (*Ann. Inst. Pasteur, 42 (1928), No. 8, pp. 841–869*).—In this first contribution, which deals with immunity to foot-and-mouth disease, it is pointed out that immunity to the O race of the organism does not confer immunity to the A race, and vice versa. Both the O and A races are widespread in various countries, the former being the more frequently met with in France, England, and Germany. The period of immunity conferred by the usual attack of the disease averages not less than one year.

On the plurality of the foot-and-mouth disease virus [trans. title], H. Vallée (*Off. Internatl. Épizoot. Bul. Mens., 1 (1928), No. 6, pp. 500–517; Ger. trans. in Berlin. Tierärztl. Wchnschr., 44 (1928), No. 45, pp. 753–758*).—The data here presented have been substantially noted in the above account by Vallée and Carré.

Vaccination against foot-and-mouth disease [trans. title], H. VALLÉE, H. CARRÉ, and P. RINJARD (*Rev. Gén. Méd. Vét., 37 (1928), No. 437, pp. 257–259; abs. in Trop. Vet. Bul., 16 (1928), No. 4, p. 134*).—A method consisting in the use of a formolized vaccine is reported upon. The entire body of an infected guinea pig is used as a source of the virus.

Trichinosis, a disease caused by eating raw pork, B. SCHWARTZ (*U. S. Dept. Agr. Leaflet 34 (1929), pp. 8, figs. 4*).—A practical account of trichinosis.

The effect of an alternating electric current on tubercle bacilli in milk, C. M. CARPENTER (*Jour. Infect. Diseases, 44 (1929), No. 5, pp. 347–356*).—The author finds the electrical conductivity method of treating milk to effectively destroy tubercle bacilli with which milk has been artificially inoculated.

Contribution to the epidemiology of undulant fever of man in the Netherlands: The occurrence of Brucella abortus (Bang) in milk and butter [trans. title], J. VAN DER HOEDEN (*Tijdschr. Diergeneesk., 56 (1929), Nos. 5, pp. 217–231; 6, pp. 295–303; Ger., Eng., Fr. abs., pp. 301–303*).—This further account (E. S. R., 60, p. 478) is based upon 24 cases of undulant fever in man met with from November, 1927, to February, 1929. All but one of these were native cases thought to be caused by the consumption of raw milk and cream. Of 60 samples of milk received from the environs of Utrecht coming from 56 farms and 30 milk dealers, 17, originating on 30.3 per cent of the farms and from 46.6 per cent of the distributing dealers, contained Brucella.

Further studies on the value of non-virulent living culture vaccination of cattle against Brucella abortus infection, I. F. HUDDLESON (*Michigan Sta. Tech. Bul. 98 (1929), pp. 11; Chart Sect., pp. 15*).—This is a report of work conducted in continuation of that in 1924 (E. S. R., 52, p. 581), in which it was shown that a nonvirulent living culture of *B. abortus* could be injected subcutaneously into both pregnant and nonpregnant cattle without harmful effects, and that cattle which had been treated possessed immunity against *B. abortus* infection. In the present account the results and effects of injecting a nonvirulent living *B. abortus* vaccine into 175 nonreacting breeding cattle in 10 different herds are considered. In addition to the nonreacting animals in the 10 herds, there were also 152 untreated animals reacting to the agglutination test.

During the first year following the vaccine treatment, 7 animals, or 4 per cent, of the nonreacting treated animals aborted. Of those observed during a second period, 108 in number, only 1, or 0.9 per cent, aborted. In the 152 reacting animals, 37, or 24 per cent, aborted during the first year of observation and 6, or 9.8 per cent, of 61 during the second year. Only 5 of the treated animals were sold because of breeding trouble, while 38 of the reacting ones were sold for this reason. There was no indication that the vaccine caused any harmful effects or reduced the breeding efficiency of the treated animals.

The breeding data and a few bacteriological data, which are presented in tabular form in the chart section, indicate that a high percentage of the animals were protected against *B. abortus* infection.

Infectious abortion of cattle is very costly, E. T. HALLMAN (*Michigan Sta. Quart. Bul., 11 (1929), No. 4, pp. 157–160*).—This is a brief practical account in which loss prevention methods are summarized.

On the morphology, transmission experiments, and clinical importance of the trichomonads occurring in sporadic abortion of cattle [trans. title], L. RIEDMÜLLER (*Centbl. Bakt. [etc.], 1. Abt., Orig., 108 (1928), No. 1–4, pp. 103–118, figs. 4*).—The work here reported upon at length, including transmission experiments, failed to give positive proof of the pathogenicity of the trichomonads found in fetuses, and further studies are considered advisable. A list is given of 37 references to the literature.

Nasal granuloma of cattle in Bihar and Orissa, P. N. Das (*Jour. Compar. Path. and Ther., 42 (1929), No. 1, pp. 24–33*).—It is concluded from experience in the field and the results of the experiments here described that under ordinary conditions nasal granuloma can not be transmitted from animal to animal or through the agencies of soil, fodder, or water.

"Apparently the infection also can not be transmitted by subcutaneous, submucous, or intravenous injection of diseased material. The disease also does not appear to be capable of transmission through the nose string of affected animals. At any rate the experiment failed to demonstrate such a possibility

"Treatment with potassium iodide is not effective. For a medium-sized animal the best results may be expected from injections of 10 grains of tartar emetic in 20 cc. of distilled water administered at intervals of four days. Massive doses do not appear to have any curative effect. A sound plan would appear to be to repeat the injections in small doses (10 to 12 grains) and at less than four days intervals. When smaller doses are employed the interval may be reduced to one day."

Nutrition vs. treatment as a stomach worm preventive, D. S. Bell (*Ohio Sta. Bul. 431 (1929), p. 112*).—The work conducted in 1927 has shown that a high plane of nutrition, effected by allowing the lambs all of the mixed grain they would eat, aided the lambs to withstand infestation and to rapidly increase in weight. Since 5 of the 15 lambs in the lot tested showed a medium to heavy infestation, it would appear that liberal feeding can not be relied upon as a stomach worm preventive. With another lot of lambs given the same test it was found that those treated at regular monthly intervals with a 1.5 per cent copper sulfate solution and allowed all of the grain they would eat harbored only 6.8 per cent as many worms as others not fed grain and not treated with copper sulfate solution. The regular monthly treatment alone, as indicated by still another group of lambs, was only 3.2 per cent less effective against the worms than the combination of feed and treatment.

[Studies of reindeer, their diseases, care, etc.] (*Trudy Sibirsk. Vet. Inst. No. 8 (1927), pp. 1–19, pl. 1, pp. 21–38, 49–54, pls. 2, pp. 55–63, 65–71, pl. 1, pp. 73–91, 107–112, 113–153, pls. 2, pp. 161–193, 209–215, 245–248*).—The translated titles of the contributions included are as follows: Plexus sacralis of the Reindeer (pp. 1–19) and The Muscles of the Pelvic Extremities of the Reindeer (pp. 21–38), both by S. A. Arkhangel'skii; a Warble Fly (*Oedemagena tarandi*) of Reindeer (pp. 49–54), Echinococcus in Reindeer (pp. 55–59), Lungworm Disease among Reindeer (pp. 61–63), the Therapeutic Value of the Maral Deer Horns and the Future Breeding of Marals in Siberia (pp. 65–71), and Literature on Reindeer Husbandry and the Pathology of the Reindeer (pp. 73–91), all by S. A. Grüner: On the Problem of Maral Husbandry, by F. P. Andreev (pp. 107–112); Maral Deer and Maral Husbandry, by G. A. Nikol'skii (pp. 113–153); Investigations of Deer Herds in the Ilimpiisk Tundra (Siberia) and Deer Diseases, by A. A. Kovrigin (pp. 161–193); The Presence of Elastic Cartilage in the Tracheal Rings of the Reindeer (*Rangifer tarandus*), by A. Efimov (pp. 209–215); and Experiments and Investigations on the Treatment of the So-called Hoof Disease of the Reindeer, by S. A. Grüner (pp. 245–248).

Bang's disease in the equine: Pyogenic localizations [trans. title], P. Rinjard and A. Hilger (*Bul. Acad. Vét. France, 1 (1928), No. 7, pp. 272–281; abs. in Trop. Vet. Bul., 17 (1929), No. 1, pp. 17, 18; North Amer. Vet., 10 (1929), No. 1, pp. 17, 18*).—The authors call attention to *Brucella abortus* as a cause of fistulous withers and other suppurative lesions in equines. Since it has been found that normally horse serum agglutinates *B. abortus* in strong concentrations only, the authors consider reactions in dilutions above 1 in 50 to indicate

actual infection. Such reactions together with bacteriological findings have furnished convincing evidence that *B. abortus* is sometimes the cause of suppurative lesions in equines.

Prior to the war one of the authors was practicing in a stock-raising area where outbreaks of abortion were not encountered, but on his return in 1919 he found that large numbers of outbreaks were occurring, and serological tests showed that in practically every case *B. abortus* and not *B. abortivo-equinus* was responsible. It was also observed that suppurative lesions of the withers and poll occurred with far greater frequency than before, and no traumatism could be found to account for them. These cases occurred, moreover, on farms where abortion existed. Agglutination tests for *B. abortus* were made of 15 horses affected with fistula of the withers or poll evil, and positive agglutination was obtained at dilutions of from 1:100 to 1:1,000 in all but two.

The authors have not produced poll evil or fistulous withers with the organism, but they have shown that the subcutaneous injection of a culture leads to the production of an abscess containing pus with the same characters as that obtained when naturally developed lesions are opened surgically.

A discussion of the paper entered into by Césari and Lignières follows (pp. 279–281).

[Work with diseases of poultry at the Ohio Station], B. H. EDGINGTON and A. BROERMAN (*Ohio Sta. Bul. 431 (1929), pp. 119–122*).—In work with 4- to 6-weeks-old chicks artificially infected with avian coccidia, no protection was obtained from feeding an all-mash ration to which 10, 20, or 30 per cent of dried buttermilk had been added. In a second test, 4 groups of chicks were used. Groups 1 and 2, fed a ration containing 10 and 30 per cent of dried milk, respectively, received their infection at the time the milk feeding was begun. Groups 3 and 4 received a ration containing 30 per cent of dried milk. In group 3 the coccidial material was given 3 days prior to starting the milk feed, while in group 4 it was given 3 days after the beginning of the milk feeding. Group 1 had a mortality of 84 per cent; group 2, 66 per cent; group 3, 83 per cent; and group 4, 88 per cent. In a third trial conducted in cooperation with A. R. Winter, birds of groups 1 and 2 received a ration containing 10 and 40 per cent of dried skim milk, respectively; group 3, 10 per cent of dried milk and 15 per cent of cane molasses; and group 4, 10 per cent of dried milk and 15 per cent of dried whey. Each group was started on its feed 7 days prior to the administration of the coccidial material. Of the 20 birds in each group, 7 died in No. 1, 14 in No. 2, 11 in No. 3, and 12 in No. 4.

In work with pullorum disease tests were made to determine the effect that the retaining of chicks in a darkened brooder 72 hours after hatching might have on the transmission of the disease, the light being restricted to such a degree that the chicks did not pick at feed scattered over the brooder floor. The results obtained from the tests, in which the artificial method of exposure to infection was used, indicated that the "dark brooding" is of value in controlling the spread of the infection in chicks. No benefit was obtained from the use of zinc, calcium, or sodium sulfocarbolates and mercuric chloride in drinking water.

In immunization of fowls against fowl pox, in which the virus was prepared from the scabs and subepithelial tissue of acute pox lesions, four methods of vaccination were used. These consisted of the scarification of a defeathered portion of the skin over the thigh, and the plucking of 1, 5, and 10 feathers from a similar region, the vaccine being applied to these areas with a small stiff brush. Each method of application appeared to be effective in producing immunity to pox, as determined by resistance to artificial infection when applied 4 months after vaccination.

Bacillary white diarrhea, J. R. Beach (*Vet. Alumni Quart.* [*Ohio State Univ.*], *16* (*1929*), *No. 4, pp. 103–119*).—This is a discussion of various phases of the pullorum disease problem based upon the results of research work at different institutions, including that of the author.

On a dilution phenomenon observed in the titration of the serum of fowls immunized against the virus of fowl plague, C. Todd (*Brit. Jour. Expt. Path., 9* (*1928*), *No. 5, pp. 244–252*).—"A mixture of fowl plague virus with the corresponding immune serum, so prepared as to be just nonvirulent when injected intramuscularly into a fowl, is rendered virulent by simple dilution with saline. This dilution phenomenon takes place even after the undiluted mixture has been kept at 37° C. for 4 hours, showing that the action of the immune serum is not that of destroying the virus in vitro, but that the virus and immune bodies can exist side by side in the mixture without destruction of the former. Similarly a mixture of the virus with just enough immune serum to render the mixture harmless to fowls when injected intramuscularly is found on intravenous injection to give rise to acute fowl plague, although the fowl is apparently not more susceptible to intravenous than to intramuscular injection of the virus.

"This behavior of mixtures of the virus with its immune serum resembles the behavior of toxin-antitoxin mixtures observed in the case of tetanus, diphtheria, and certain other toxins. The dilution phenomenon is of practical importance in the titration of immune sera against the corresponding viruses, as the degree of dilution of the infected mixture may, within certain limits, influence the result of the injection."

Leg-weakness in poultry: A preliminary note on the occurrence of a specific fowl paralysis in South Africa, A. D. Thomas (*Jour. So. African Vet. Med. Assoc., 1* (*1928*), *No. 2, pp. 67–72, pl. 1*).—The author draws attention to a specific form of leg weakness or paralysis of fowls which hitherto has escaped the notice of veterinarians in South Africa. It is characterized by round cell infiltration of the nerve tissues and probably others also, giving rise to a wide variety of symptoms according to the location of the lesions but most commonly manifesting itself as a paralysis or paresis of the limbs.

Vitamin D and resistance of chickens to parasitism, J. E. Ackert and L. A. Spindler (*Amer. Jour. Hyg., 9* (*1929*), *No. 2, pp. 292–307*).—This is a contribution from the Kansas Experiment Station. Four experiments with 150 chickens were carried out by the authors to ascertain if lack of vitamin D lowers the resistance of chickens to the intestinal nematode *Ascaridia lineata* (Schneider).

Leg weakness failed to develop in the first experiment (10 weeks' duration), apparently because of the inclusion of potassium phosphate in the diet, and no evidence was obtained to indicate that the lack of vitamin D lowered the resistance. In the second experiment leg weakness occurred in the minus D group on the twelfth day (age of chicks, 20 days), and both groups were parasitized 4 days later. At autopsy the worms were neither significantly larger nor more numerous in the minus D group than in the controls, failing to prove that the resistance of these chickens to parasitism had been lowered by the lack of vitamin D.

Chicks kept on a plus D diet 2 weeks before insolation (experiment 3) did not show leg weakness until nearly 8 weeks later, when all birds were parasitized. A significantly larger number of worms remained in the minus D group, but their length was not greater. This difference is attributed to a small amount of fat-soluble vitamin A probably present in the cod-liver oil given to the plus D group. Sixteen chickens, or 80 per cent of the controls, threw off all their worms, while only 6, or 30 per cent, of the minus D group

freed themselves of the parasites. After being on a plus D diet 9 days before isolation (experiment 4), the minus D chicks yielded to leg weakness in from 16 to 33 days, when (thirty-third day) both groups were parasitized. Neither from the numbers nor from the sizes of the worms was there any evidence that the resistance of the chickens to the parasites had been lowered.

The rate of growth of the minus D chickens was slower than that of the controls. The effects of parasitism as judged by the rate of gain in weight were more severe in the minus D group, indicating that vitamin D is a factor in protecting chickens against effects of the nematode. The occurrence of highly resistant chickens in a fowl population was shown in these experiments, in which approximately one-fourth (39) of the 150 chickens eliminated all of the worms from their bodies before the time of autopsy (3 weeks after parasitizing).

A list of 18 references to the literature is included.

Epidemiological studies of blackhead in turkeys.—II, Ordinary barnyard fowl as important agents of transmission, L. F. Rettger, W. F. Kirkpatrick, and J. G. McAlpine (*Connecticut Storrs Sta. Bul. 156 (1929), pp. 251–258*).—The results here reported, which add definite support to the abundant circumstantial evidence given in Bulletin 148 (E. S. R., 59, p. 477), indicate that chickens are decidedly more dangerous carriers than are turkeys themselves. It is pointed out that while in commercial turkey rearing it is impracticable or impossible to rear turkeys apart from turkeys, it is practicable to rear them on grounds which have not been occupied for at least 2 or 3 years, except perhaps casually, by ordinary barnyard fowl.

The results of this experiment indicate, as did those of previous years, that rotation of yards leads to material saving against losses from blackhead.

AGRICULTURAL ENGINEERING

[Agricultural engineering investigations at the Michigan Station], H. H. Musselman (*Michigan Sta. Rpt. 1927, pp. 357, 358*).—A brief statement of progress in investigations in power and machinery, buildings and conveniences, and drainage and land development at the station is given. Tests of mole drainage over three years showed that the annual cost of this system will be but a fraction of the annual costs of tile drainage. In corn borer control, three wires attached to the beam shank and evener on the single plow were found to be effective in covering stalks.

Water supply from rainfall on valley floors, A. L. Sonderegger (*Amer. Soc. Civ. Engin. Proc., 55 (1929), No. 5, pt. 1, pp. 1139–1165, figs. 13*).—This paper presents an analysis of the phenomenon of rainfall penetration on valley floors in semiarid areas and a discussion of methods for the quantitative determination of the resulting water supply, with special reference to conditions in southern California. Particular attention is devoted to the determination of rainfall penetration from soil moisture tests and from springs in the Murrietta-Temecula area, the determination of penetration on valley floors by comparison with mountain run-off in San Bernardino Valley, and the determination of penetration from rainfall and irrigation rise of water in test wells in Pauba Valley.

The results show that for an alluvial valley fill of crystalline origin the distribution and rate of penetration of moisture from rainfall over large areas are essentially nonuniform and percolation will concentrate in numerous well-defined ducts. Deep penetration may occur during years of deficient rainfall when the maximum consumptive use of the cover is not satisfied; particularly is this true when the formation is modern.

For like seasonal rainfall the intensity of the maximum storm of a season is greater in the valley than in the mountain watershed, and so is also the resulting water supply. For like intensity of the maximum seasonal storm the water supply produced in the valley is approximately the same as that in the mountains, conditions of cover and soil being similar. Given the relation of maximum seasonal storms of mountains and valley, deductions may be made from the known run-off of a mountain area to the available water supply of the adjacent valley floor.

There appears to be a more or less fixed relation between the seasonal rainfall of a watershed and the consumptive use of its cover, which remains approximately the same for kindred watersheds of a region. Inasmuch as the consumptive use is only the complement to the run-off, the rainfall run-off relation of a mountain watershed will permit of definite conclusions as to the water supply from local rainfall of its adjacent recipient valley area if these relations are reduced to a common basis and expressed in percentage of the mean rainfall. Storm run-off of the valley floor is a minor factor, except for compact formations under the effect of the maximum storm of a wet year. A substantial percentage of the rainfall on the valley floor becomes available, varying with the amount of precipitation, the wetness of the preceding season, and the character of soil and cover.

A study of ground water in the Pomperaug Basin, Connecticut, with special reference to intake and discharge, O. E. Meinzer and N. D. Stearns (*U. S. Geol. Survey, Water-Supply Paper 597–B (1929), pp. IV + 73–146, pls. 9, figs. 9*).—This report, prepared in cooperation with the Connecticut State geological and natural history survey, presents data on the topography, drainage, geology, and water resources of the Pomperaug Basin in Connecticut.

Surface water supply of Snake River Basin, 1927 (*U. S. Geol. Survey, Water-Supply Paper 593 (1929), pp. VI + 264, fig. 1*).—This report, prepared in cooperation with the States of Idaho, Oregon, Nevada, and Washington, presents the results of measurements of flow on streams in the Snake River Basin during the year ended September 30, 1924.

Water distribution by different spraying devices under winds of variable strength, P. Szobotka (*Die Wasserverteilung. Verschiedener Beregnungs-Apparate bei Verschieden Starkem Wind. Diss., Landw. Hochsch., Berlin, 1928, pp. 46, figs. 17*).—The results of tests to compare the spraying capacities of so-called quadrat nozzles, which spray in all directions at the same time, and circular nozzles with revolving vanes when operating under different wind velocities are reported in considerable detail.

The water distribution by the nozzles with revolving vanes was found to be unfavorably influenced by increasing wind velocities. The water distribution by the quadrat nozzles was not so adversely influenced by wind velocity. Some of these nozzles, which agitated or broke up the spray, gave the best results under wind velocities around 10 ft. per second.

The quadrat nozzles also accomplished the best water distribution. The results with the circular nozzles were improved by reducing their spraying radius and by reducing the revolving speed of the vanes.

Fluid meters: Their theory and application, Part I, R. J. S. Pigott et al. (*New York: Amer. Soc. Mech. Engin., 1927, pt. 1, 2. ed., [rev.], pp. 92, figs. 37*).—This is the second revised edition of this report, which is intended as a reference book on fluid meters of all kinds. It contains practical information for users of meters and general information relating to the physical principles of design and operation. Chapters are included on classification of fluid meters, weighing meters, volumeters, current or kinematic meters, head or dynamic meters, area or geometric meters, head-area meters, force meters, and thermal

meters. A summary of the important formulas involved and a discussion of the theory of head meters, together with data on nomenclature and a bibliography, are included in four appendixes.

The drainage of land overlying artesian basins, W. Gardner, O. W. Israelsen, and W. W. McLaughlin (*Soil Sci., 26 (1928), No. 1, pp. 33–45, figs. 3*).—This is a highly technical theoretical analysis, made at the Utah Experiment Station, of the movement of water into drains in land overlying artesian basins and of the cost elements in drainage by pumping.

Report of the Royal Commission on Land Drainage in England and Wales, Lord Bledisloe et al. (*London: Govt., 1927, pp. 60, pl. 1*).—This is the report of a commission appointed to inquire into the present law relating to land drainage in England and Wales and its administration. The recommendations arising from this inquiry indicate the desirability of consolidating and amending the law, with particular reference to the formulation of what corresponds to drainage districts in America.

Public Roads, [May, 1929] (*U. S. Dept. Agr., Public Roads, 10 (1929), No. 3, pp. 37–64, figs. 27*).—This number of this periodical contains the status of Federal-aid road construction as of April 30, 1929, together with the following article: Interrelationship of Load, Road, and Subgrade, by C. A. Hogentogler and C. Terzaghi.

The failure of plain and spirally reinforced concrete in compression, F. E. Richart, A. Brandtzaeg, and R. L. Brown (*Ill. Univ., Engin. Expt. Sta. Bul. 190 (1929), pp. 74, figs. 23*).—This extensive set of studies (E. S. R., 60, p. 376) indicates that the behavior of plain concrete in simple compression may be considered for three stages of loading, each having certain special characteristics. In the first stage the material acts like an elastic material, stresses and strains being proportional. The second stage is marked by appreciable deviations, particularly of the lateral strains, from the linear stress-strain curves of the first stage, and a steady increase in the ratio of lateral to longitudinal strains. The beginning of the third stage is marked by an abrupt increase in the ratio of lateral to longitudinal strains; as a consequence the volume of the material, which had been decreasing under increasing loads, changes its behavior radically and increases with further loading.

The action of spirally reinforced columns at the early stages of loading is essentially the same as that described for the first and second stages of loading of plain columns. During the second stage plastic deformation of the material begins and the lateral deformations become large enough to produce a small stress in the spiral, which in turn exerts a slight lateral pressure on the concrete core. The third stage, which has been denoted as the "spiral range" of action, begins at a load corresponding to that at which the splitting of plain concrete begins.

An important result of the tests was the determination of a fairly definite relationship between longitudinal and lateral stresses within the spiral range. The relation $f_1=f_0'+4.1f_2$ was found to apply at the maximum as well as at lower loads; and to individual columns as well as to the average of each group of columns. In this relation f_1 is the axial compressive unit stress, f_2 is the lateral compressive unit stress, and f_0' is the compressive strength of plain concrete.

A large number of other findings are reported. However, in general the tests provided three related sets of observations, namely: (1) A relation between longitudinal and lateral stresses; (2) a general rule regarding the depression of the spiral steel into the concrete; and (3) a relation for the variations in volume during loading. Together these relations, if sufficiently general and accurate, provide complete information regarding load-deformation relations in

spirally reinforced members. Of the three, the third is least reliable and general in application, while the first is the most applicable and useful. It alone furnishes a rational basis for an analysis of the strength properties of this type of member.

Winter construction methods, C. S. Hill (*New York and London: McGraw-Hill Book Co., 1928, pp. XI + 180, figs. 77*).—This book deals with processes and plant employed in prosecuting construction operations in cold weather.

It contains chapters on economics and cost of winter construction; winter efficiency and servicing of labor; water supply, fire protection, and camp heating; construction elements affecting winter work; transporting and storing materials in winter; winter care and servicing of equipment; winter excavation and embankment construction; ice service and hazard in winter work; concrete pavement and road-bridge construction in winter; special concretes and cements for winter work; winter heating of concrete materials and mix; handling and placing concrete in winter; protecting concrete in heavy sections; progressive canvas housing for building construction; winter building using complete inclosure; supplementary services in winter construction; and specifications for winter construction.

The accomplishment of teams in field work, F. Wollner (*Beiträge zur Kenntnis der Leistung von Gespannen bei der Feldarbeit. Inaug. Diss., Landw. Hochsh., Berlin, 1927, pp. 77, pl. 1, figs. 5*).—The results of a time and accomplishment study of animal traction in the operation of various field machines are reported in detail and discussed.

A chart by which the cost of operation may be determined by electric appliances and motors (*Iowa Agr. Col. Off. Pub., 27 (1928), No. 12, Sup., pp. [4], fig. 1*).—The chart is given together with data on usual current consumption of electric appliances and average current consumption of motors at full load.

Utilization of electric equipment and appliances in the farm home, H. C. Brigham, F. J. Zink, and F. D. Paine (*Iowa Agr. Col. Off. Pub., 27 (1928), No. 12, pp. 56, figs. 25*).—Data obtained on the Iowa project on rural electrification at Garner, Iowa, as to the use of electricity in 11 farm homes are presented and discussed, indicating especially the electricity consumption of different types of equipment.

Harvesting corn with field ensilage cutter, E. A. Silver (*Ohio Sta. Bul. 431 (1929), pp. 141–143, fig. 1*).—Data on the use of the field silage cutter for corn harvesting, briefly reported, show that the operating costs were slightly below those where the binder silage cutter is used. The distance of hauling seriously affects the costs of operation. The wagon hoist is a great timesaver and eliminates much hard labor in unloading the wagons. The average time required to raise the wagon and unload 4,000 lbs. of silage was 5 minutes. The tractor was used to pull the wagons alongside because the harvester moves forward too rapidly for horses. It required one man 4 hours to change and sharpen the knives on the harvester. A much more uniform mixture of silage was secured.

Investigations of blowing stackers for hay and straw, I [trans. title], C. H. Dencker (*Schr. Reichskurator. Tech. Landw., No. 1 (1928), pp. 78, figs. 42*).—Studies are reported which showed that the most important defects in available blowing stacker equipment for hay and straw are a too high power requirement, a too low safety factor, and a tendency to damage the hay and straw. A large amount of technical data is presented and discussed.

Sorting phenomena occurring during the winnowing of seed grain by means of air blasts [trans. title], Brenner (*Schr. Reichskurator. Tech. Landw., No. 2, (1928), pp. 80, pls. 3, figs. 33*).—The results of an extensive

theoretical and experimental study of the phenomena involved in the sorting of grain under the influence of an air blast are reported, special attention being given to studies of individual kernel movements.

The results show that an air blast sorts grain according to average flow coefficients where the flow coefficient is the ratio of the weight of the grain to its resistance to the air blast. It appears also that previous conceptions of the surface-weight ratio were only approximately correct.

The resistance of wheat kernels to an air blast longitudinally and laterally was found to be 1:6 and of oat kernels 1:10. The theoretically possible scattering is therefore so high as to make a sharp separation of the grains appear almost impossible. However, the actual scattering by rotating the kernels in an air blast was found to be much less. Single kernel experiments on grates to produce small whirlwinds which cause the grain to rotate indicated the possibility of thereby increasing the sharpness of separation by means of air blasts. In this connection a method of procedure was developed which made possible a study of grain deviation phenomena under air blast by use of simple apparatus.

The scattering of a single grain was found to be a resultant of form and whirling factors, the influence of both of which apparently can be reduced. It appears that the scattering influence of form is dependent primarily on the length of the kernel. Form scattering decreases with time, whereas the whirling scattering in agitation processes ordinarily increases.

Apparently air blasts tend to sort according to size, due to the relatively greater surface friction of the small kernels, and can therefore separate the small kernels. Thus a sharp separation by air blast is possible which empties sieves.

It was also found that the selection of air velocity becomes especially important when the blast is directed obliquely upward. It appears that too high air velocities will prevent separation entirely. Normal air blasts were found to contain many small irregularities which can not be measured but which have an influence on grain sorting. It appears that means of detecting and correcting these are necessary.

A large amount of data is presented.

Fires in cotton gins and how to prevent them, H. E. ROETHE (*U. S. Dept. Agr. Circ. 76 (1929), pp. 8, figs. 4*).—This circular is a revision of and supersedes Circulars 28 and 271 (E. S. R., 42, p. 284; 49, p. 590). It describes the causes of cotton gin fires and the conditions under which they occur and gives information on how to prevent them.

Design for farm buildings, G. S. HENDERSON (*Agr. Research Inst., Pusa, Bul. 188 (1929), pp. 19, pl. 1*).—Specifications for farm buildings and equipment used in India are briefly presented.

Can washing machines [trans. title], SCHULZ (*Schr. Reichskurator. Tech. Landw., No. 3 (1929), pp. 91, figs. 48*).—A study is reported of the construction and adaptation of can washing machines for German dairies.

The first part of this report reviews the progress of milk-can washing and describes present methods and apparatus and their adaptation to the local German dairy industry. The second part reports tests of methods and equipment for can washing in dairies, which dealt with the mechanical, bacteriological, and chemical features of can washing and cleaning.

The results as a whole indicate the superiority of mechanical cleaning over hand cleaning for the inside of milk cans and the superiority of hand cleaning for the outside of the cans. However, it appears that the internal cleaning by mechanical means is still far from perfect, and considerable research is necessary to correct the defects of available methods and equipment.

Effect of alkaline substances on sewage sludge digestion, A. J. Fischer, W. Rudolfs, and P. J. A. Zeller (*New Jersey Stas. Bul. 474 (1929), pp. 34, figs. 17*).—This report is in three parts.

Part 1 deals with the effect of additions of certain chemicals on the rate of decomposition of raw sewage sludge. The results showed that liquefaction predominated below pH 7.2 and was greatest at the beginning of digestion. A limited amount of lime hastened digestion, primarily because of the neutralization of organic acids formed in the first stage of decomposition. Addition of sufficient lime to neutralize the acids formed during the first day gave best results. An excess of lime caused an initial retardation, digestion proceeding rapidly after the lime was neutralized. More complete digestion is not necessarily brought about by lime addition. Sodium nitrate hastened decomposition and caused more complete digestion. The more nitrate added, the faster was the rate of digestion. Determinations of pH value, biochemical oxygen demand, solids, and ash gave the best index of digestion. For practical purposes digestion was complete when the pH value was 7.6 and the biochemical oxygen demand for each per cent volatile matter was about 1,000 p. p. m.

Part 2 reports studies of the effect of alkaline chemicals upon sludge digestion. It was found that the effect of dolomite, $CaCO_3$, and $Ca(OH)_2$ upon the digestion of seeded fresh solids is indicated by the rate of gas production and the percentage of volatile matter reduction. Dolomite and $CaCO_3$ increased the rate of gas production slightly and $Ca(OH)_2$ considerably as compared with untreated mixtures. The percentage volatile matter reduction was greatest with lime and least with dolomite. The total quantities of methane produced from the different mixtures were the same after a prolonged period of incubation, but if the mixtures are compared at the time when the best mixture was ready to draw, methane production was highest from the $Ca(OH)_2$ treated material. Carbon dioxide production was lowest from the mixture treated with $Ca(OH)_2$, but this was due to the neutralization of CO_2 in solution by the lime. The amounts of chemicals needed for reaction control differed greatly. On account of the inability of dolomite to react readily with weak acid materials, the quantities needed were more than 20 times greater than hydrated lime; and the fact that potential acidity (mostly CO_2) could not be taken care of by $CaCO_3$ made it necessary to add about 8 times as much $CaCO_3$ as $Ca(OH)_2$.

Part 3 reports experiments with fresh solids seeded with ripe material from a tank in which the reaction was controlled. To seeded fresh solids not in need of reaction adjustment certain quantities of $Ca(OH)_2$ and $CaCO_3$ were added for the purpose of ascertaining their effect upon reduction of organic matter, total gas, CO_2, and CH_4 production. The reduction of volatile matter was somewhat retarded by the addition of the chemicals, but the total gas and CH_4 production per gram of volatile matter destroyed was somewhat greater. The amounts of carbon dioxide per gram volatile matter destroyed were greatest from the mixture with $CaCO_3$. However, the difference in quantity produced from the mixture with $Ca(OH)_2$ could be accounted for by neutralization of the CO_2 dissolved so that actually, also, more CO_2 per gram volatile matter destroyed was produced by the treated mixtures than by the untreated mixture.

Effect of temperature on bacterial numbers in digesting sewage sludge, H. Heukelekian and W. Rudolfs (*Jour. Bact., 17 (1929), No. 4, pp. 247–254, figs. 4*).—In studies conducted at the New Jersey Experiment Stations sewage solids subjected to different temperatures were incubated with and without additions of lime. Total bacterial counts were made and the approximate numbers of different physiological groups determined.

The average number of the different groups of organisms was not affected by different temperatures, except in the case of hydrogen sulfide producers, but the addition of lime influenced the average numbers. A wide divergence was found between total numbers of lactose formers and spore-forming lactose fermenters. With increase in temperature the divergence became smaller, so that at the higher temperatures employed the spore-forming lactose fermenting organisms constituted the majority of the lactose fermenting organisms, while the total numbers of organisms (plate counts) were greatly reduced.

RURAL ECONOMICS AND SOCIOLOGY

[Investigations in agricultural economics at the Ohio Station, 1927–28] (*Ohio Sta. Bul. 431 (1929), pp. 134–140, fig. 1*).—Results not previously noted are reported as follows:

[*Early plowing for and seeding of wheat*].—Wheat cost records of 21 Medina County farmers for the years 1921–1924 showed that fields plowed at different times had the following average yields per acre: Before August 20, 21 bu.; August 21–31, 19.5 bu.; September 1–10, 18 bu.; and September 11 and later, 16.3 bu. Fields seeded at different times had the following average yields: Before September 20, 22.1 bu.; September 21–30, 21 bu.; October 1–10, 17.2 bu.; and October 11 and later, 15.2 bu.

[*Truck marketing of livestock.*]—From 1922 to 1927 the percentages of livestock transported to the Cleveland market by trucks increased as follows: Hogs from 2.4 to 19.2, sheep from 7 to 19.1, cattle from 4.7 to 18.3, and calves from 8.9 to 21.9. There was a large increase in the amount of trucking from distances over 30 miles, the percentages trucked from within a 30-mile radius decreasing as follows: Hogs from 20.5 to 6.7, sheep from 10.4 to 5.7, cattle from 63.2 to 31.1, and calves from 30.6 to 18.6.

Variations in milk sales from northeastern Ohio farms.—The average sales per day per farm for the year, the highest month, and the lowest month were as follows: Stark County association (Canton market), 151 lbs., June, 201 lbs., and November, 120 lbs.; Summit County association (Akron market), 147 lbs., June, 186 lbs., and November, 122 lbs.; and 15 Pittsburgh plants, 147 lbs., May, 207.2 lbs., and October, 103.6 lbs.

Marketing apples.—A survey of the apply industry in Lawrence County showed no by-products plants in the county or in near-by cities. In 1927, 12 wholesale grocers in Huntington, Ashland, Ironton, and Portsmouth reported sales of apple by-products amounting to 100¼ cars, of which only 7.7 per cent originated in Ohio.

Tax valuation and sale price of farm real estate.—Data from 4,396 sales in 20 counties during 1923–1928 showed that the ratio of tax valuation to sale price of voluntary sales increased from 77.45 per cent in 1923 to 89.62 per cent in 1928, the increase being due chiefly to the decline in the average sale price from $88.92 to $75.61 per acre.

[*Cost of farm family living*].—Complete household accounts in 1927 of 69 cooperating farm families showed that the total average budget was $1,451.30, of which 20.8 per cent was furnished by the farm. The percentage furnished by individual farms varied from 7.5 to 36.8.

Movement of open country population.—Schedules taken on 515 rural families in Ashtabula, Trumbull, and Medina Counties showed that 80 per cent of the children of the native white families went into nonfarming occupations, that more than 50 per cent of the native white families had moved from other

localities during the last 30 years, and that 90 per cent of the foreign families had moved from other localities within the last 15 years.

[Investigations in rural economics at the Ohio Station] (*Ohio Sta. Bimo Bul. 138 (1929), pp. 106–111*).—Results are reported as follows:

The price of Ohio wheat, J. I. Falconer (p. 106).—A table is included showing for the crop years (July to June) 1922–23 to 1927–28, inclusive, and for July to December, 1928, the United States production of all classes of wheat and of soft red winter wheat, the average of the monthly average prices per bushel for all classes and grades of wheat at Chicago and of No. 2 soft red winter wheat at Toledo, and the difference between the Chicago and Toledo prices. The premium of No. 2 red winter wheat at Toledo over all classes and grades of wheat at Chicago for the years 1922–23 to 1927–28 varied from 4 to 17 cts. per bushel. For the period July to December, 1928, the premium was 36 cts. per bushel.

Real estate tax and income to owner on cash-rented farms in central Ohio, H. R. Moore (p. 107).—A survey of approximately 50 cash-rented farms in Madison County and the southern part of Union County showed the following averages per acre for 1928: Cash rent $5.94, landlord's expenses other than taxes $1.36, and real estate taxes $1.57. Taxes amounted to 34.28 per cent of the rent after deducting other expenses.

Produce receipts by rail and by truck on the Columbus wholesale market, July 2–December 31, 1928, C. W. Hauck (pp. 108, 109).—Tables are given showing the average receipts by truck on the different days of the week, the monthly receipts by rail and by truck, and the receipts by rail and by truck of different kinds of produce for the period.

Age distribution of Ohio farm population, P. G. Beck (p. 110).—Data gathered in 1927 and 1928 from 1,080 farm families in different sections of the State showed the following age distribution: Under 20 years 43.1 per cent, 20 to 39 years 22.6, 40 to 59 years 22.1, and 60 years and over 12.2 per cent, as compared with 41.5, 26.1, 21.7, and 10.7 per cent for Ohio farm population, and 36.6, 33.7, 20.8, and 8.9 per cent for total Ohio population, as shown by the 1920 United States census.

Index numbers of production, prices, and income, J. I. Falconer (p. 111.)—The table previously noted (E. S. R., 61, p. 181) is brought down through February, 1929. A revised index of the "Ohio cash income from farm sales" is introduced. This new index uses the years 1910 to 1914 as a base.

The taxation system of Kansas, H. Howe (*Kansas Sta. Circ. 144 (1929), pp. 24, fig. 1*).—This circular describes the principal taxes levied in the State—general property, gasoline, and motor license, inheritance, cigarette, intangible property, and miscellaneous taxes and fees—and the methods used in taxing corporations, banks, and insurance companies. Tables are given showing the amounts of taxes of different kinds levied for the fiscal year 1928 for State, county, township, city, school district, and special assessment district purposes. A brief description is included of the sources and uses of Federal revenues.

Labor requirements of farm products in the United States: A list of references to material published since 1922, compiled by L. O. Bercaw (*U. S. Dept. Agr., Bur. Agr. Econ. Bibliog. 26 (1929), pp. 62*).—This is a mimeographed list of references to publications, principally of the United States and the several States, issued since 1922, which give the actual number of hours of labor required to produce individual crops and livestock.

What makes some farms pay? E. B. Hill and F. T. Riddell (*Michigan Sta. Spec. Bul. 187 (1929), pp. 26, figs. 6*).—This bulletin reports the results of a business analysis survey in Eaton County, Mich., of 13 farms of from 37

to 60 acres, 32 of 61 to 100 acres, 35 of 101 to 140 acres, 16 of 141 to 180 acres, 8 of 181 to 220 acres, and 10 farms with 221 acres or over.

Tables are given and discussed showing by the size groups and for the one-third of each group having the highest labor income and the one-third having the lowest labor income, where the number of farms in the group justified such division, the average investment, total and by items; acres operated and cropped; acreage and yields of different crops; number of cows, sows, ewes, and hens and the gross income per unit of each; man equivalent per farm; power units used; receipts and net increase, total and by items; expenses and net decrease, total and by items; farm income; rate earned on investment; operator's labor and management wage; and other items affecting returns of the farm business. Tables are also included showing comparisons of the several factors for a farm with high returns and one with low returns in the 80-acre, 140-acre, and 200-acre groups.

The data showed that (1) the higher incomes were usually obtained on the farms with the larger volume of business; (2) the most successful farmers usually kept from 25 to 50 per cent more livestock and had from 15 to 40 per cent higher production per unit; (3) the more successful farmers obtained about two-thirds of their total farm receipts from livestock and one-third from crops, as compared with 57 and 36 per cent, respectively, for all farms; (4) cattle, mostly dairy, were the source of 35 per cent of the total farm receipts; (5) the more successful farmers grew more than the average acreage of feed crops, corn, alfalfa, oats, and barley, and a smaller acreage of cash crops, wheat, and beans; (6) man labor was from 25 to 50 per cent more efficient on the higher profit farms; (7) on farms of similar size the operating expenses were about the same regardless of income; and (8) on farms with a larger income the added expenses were less than the increase in returns, due to the additional volume of business handled.

Proposed plan looking toward adjustments in the agriculture of Illinois, H. W. MUMFORD (*Illinois Sta. Circ. 340 (1929), pp. 14, fig. 1*).—An address before a conference of farm advisers, vocational agriculture teachers, and advisory committees of the College of Agriculture and Experiment Station at the eleventh annual meeting of the American Country Life Association at Urbana, Ill., June 20, 1928. The proposals of the college for the carrying out of plans and programs looking to agricultural progress in the State are outlined.

The corn enterprise in Iowa, E. B. HURD (*Iowa Sta. Bul. 259 (1929), pp. 225–256, figs. 16*).—This bulletin is the second of the series previously noted (E. S. R., 60, p. 884). Maps and graphs are included showing the percentage of farm land in corn in 1925 by townships; changes in the percentage of farm land in corn, 1890–1927; and the relations between the percentage of land in corn and the soil areas; and by counties the percentage of grain land in corn; the ratio of corn yields to oat yields, average 1916–1925; percentage of merchantable corn, average 1923–1927; average per acre yield of corn, 1916–1925; corn production per 100 acres in farms; percentage of corn sold, average 1923–1926; average number of bushels sold per 100 acres in farms, 1923–1926; and the average number of bushels fed per 100 acres in farms, 1923–1926.

The factors determining the amount of corn raised and sold in different sections of the State and by individual farmers are discussed.

The McIntosh apple industry in western Montana, S. E. JOHNSON (*Montana Sta. Bul. 218 (1929), pp. 62, figs. 18*).—The development and present status of the industry are described. The production problems—climatic conditions, soils, orchard location, yields, competition from other areas, and the place of apples in the farm organization of the area; the marketing problems—market outlets, local organization, methods of sale, local expenses, shipping expenses,

possibilities of decreasing costs, local and New York City prices, and the possibilities of increasing prices received through proper grading, increasing the size of apples, keeping low grades off the market, and the development of by-products, home markets, and new market outlets; and the future of the industry in the area are discussed.

Attitudes of Oklahoma farmers toward the Oklahoma cotton growers' association, W. W. Fetrow (*Oklahoma Sta. Bul. 178 [1929], pp. 60, figs. 12*).—This report analyzes the data obtained in a study made in cooperation with the Bureau of Agricultural Economics, U. S. D. A. The data were obtained by personal visits to 519 members and 336 nonmembers of the association in three sections of the cotton belt of Oklahoma. Both owners and tenants were included, and the data are tabulated for each class.

The questionnaires used covered members' reasons for joining the association; their previous cooperative marketing experience; their understanding of the association's contract before signing; their satisfaction with the association, its contract, expenses, etc.; their understanding of the association's method of making payments and pooling cotton; their attitude toward the contract, contract violations, and withdrawals from membership; their satisfaction with the officers and field service of the association; the attitude of members' wives, ginners, cotton buyers, merchants, lawyers, school teachers, and preachers toward the association; the reasons given by nonmembers for not joining the association and the conditions under which they would join; the opinion of members and nonmembers as to whether cooperative associations will ever be able to fix prices, secure cost of production, or control acreage; and the benefits of the association to members and nonmembers through higher prices and payments more nearly according to grade, etc.

The study showed that the greatest handicaps to, and reasons for objection to, the association were lack of experience of the members in cooperative endeavors, erroneous ideas as to what the association would accomplish, lack of understanding of the contract, lack of appreciation of their obligations under the contract, need of cooperation of various groups other than cotton growers, lack of complete confidence in the management of the association, need of closer contact between the central organization and the membership, and need of more consideration of the social and economic conditions of the farmers.

Seasonal features of Illinois grain marketing, L. J. Norton and C. L. Stewart (*Illinois Sta. Bul. 324 (1929), pp. 46, figs. 19*).—This bulletin reports the results of a study of the seasonal features of the marketing of wheat, corn, and oats, the storage capacity of country elevators, and farm storage. The part pertaining to elevators is based on data obtained by representatives of the station and from questionnaires filled out by managers of the elevators from approximately 280 elevators for the years 1923–24 and 1924–25 and from 152 elevators for the year beginning July 1, 1925. Both farmers' organizations and privately owned elevators are included. The data on farm storage were obtained from 471 farmers in all sections of the State.

In the 3 crop years 76.7, 73.5, and 64.4 per cent, respectively, of the wheat shipments were made between July 1 and October 1. Of the corn shipments 29.1, 30.7, and 29.6 per cent, respectively, were made from July 1 to October 31; 41.1, 48.1, and 43.8 per cent, respectively, from November 1 to February 28; and 29.6, 21.2, and 26.6 per cent, respectively, from March 1 to June 30. Shipments of oats varied considerably, averaging approximately 34 per cent from July 1 to September 30, 17 per cent from October 1 to December 31, 25 per cent from January 1 to March 31, and 24 per cent from April 1 to June 30. The time of purchase by elevators and time of shipments was found to vary but little for wheat and corn. With oats there was a persistent

tendency for shipments to be more uniformly distributed throughout the year than purchases. The differences in seasonal shipments of the 3 grains in the different sections of the State, the usual seasonal changes in prices, the seasonal changes in prices during the period of the study, and the comparative earning opportunities on hedged and unhedged oats., 1921–1927, are discussed.

The average storage capacity of country elevators in 1925 was 38,750 bu., exclusive of corncrib capacity, for the 344 elevators reporting, and 12,360 bu. for corncribs for the 155 elevators reporting. The 471 farmers reporting had an average corncrib capacity of 2,978 bu., as compared with an average production in 1922–1926 of 2,848 bu., and an average tight-bin capacity of 2,068 bu., as compared with an average production of 1,990 bu. Nearly 75 per cent of the farmers reported that lack of storage space was not a factor in determining the time of sale, and only 9 per cent stated that it was a factor in 3 or more of the 5 years, 1922–1926. Nearly 75 per cent stated that lack of credit did not influence the date of sale, and only one-sixth indicated that lack of credit influenced the time of sale in 3 or more of the 5 years.

Wholesale marketing of live poultry in New York City, F A. BUECHEL (*U. S. Dept. Agr., Tech. Bul. 107 (1929), pp. 68, figs. 34*).—"This bulletin aims to present the economic situation of the live poultry industry of New York City, including the sources of supply and of demand for this commodity, the growth and present size of the industry, and the different groups of people who are engaged in moving live poultry from the open country to the retail channels in New York City." The data upon which the bulletin is based were obtained chiefly from the daily records of volume by classes, costs of marketing within the city, and the prices of live poultry obtained from the books of live poultry commission men for the years ended October 31, 1924, and April 30, 1926. Supplementary data were obtained by a questionnaire from the shippers, and more general data from the reports of this Department and of the Urner-Barry Publishing Co., of New York City.

Tables and graphs are given and discussed showing the origin of different classes of live poultry shipped into New York, the seasonal variations in receipts of different classes, the demand for live poultry, cost of marketing, returns to shippers, and prices and supply movements of the principal classes of poultry. The size and growth of the industry, its organization, the price-making mechanism, and the advantages of a union terminal and live poultry exchange are discussed.

The total cost of marketing live poultry from shipping point to slaughterhouse was found to vary from 4.56 cts. per pound for Ohio to 8.99 cts. for Texas, averaging 6.13 cts. for the 16 States and 2 cities included. This cost was divided as follows: Transportation 3.88 cts., commission 1.02, coops 0.63, cartage 0.27, and unloading 0.33 ct.

A statistical analysis of the average weekly price of colored fowl, November 1, 1923, to October 31, 1924, and May 1, 1925, to April 30, 1926, showed that the chief factors affecting prices and the approximate percentage of the variation in prices for which each factor was responsible were expected receipts for the week 40 per cent, prices during the previous week 25 per cent, kosher veal prices 5 per cent, and maximum temperature during the week 8 per cent. The purchasing power index in New York City, prices of kosher lamb and beef, seasonal variation in price and volume of live poultry, dressed poultry, and storage holdings had but little influence on the changes in the weekly prices of live poultry. Important Jewish holidays caused an increased demand of from 15 to 50 per cent above the average of the previous two weeks.

An increase of 20 carloads was found to decrease prices over 1.6 cts. per pound when the expected weekly receipts were less than 220 carloads, and

0.9 ct. when the expected receipts were from 200 to 360 carloads. With each 5 cts. per pound increase in the price of kosher veal, colored fowl prices increased 8 cts. per pound. An increase of 10° F. in temperature tended on an average to depress the price of colored fowl 0.5 ct. per pound. Using only the prices during the two previous weeks, it was found that in about two cases out of three the price for the current week could be estimated within 2 cts. of the actual price. The average increase per pound due to different Jewish holidays varied from 0.5 to 6 cts. A change of 5 per cent of the business index of New York City was found to be accompanied by a change of only 0.4 per cent in colored fowl prices.

Factors affecting the price of peaches in the New York City market, H. S. Kantor (*U. S. Dept. Agr., Tech. Bul. 115 (1929), pp. 64, figs. 22*).—This bulletin reports the results of a study made in cooperation with the New Jersey Experiment Stations. Tables and charts are included and discussed showing by years, 1910 to 1928, inclusive, the production and average prices of peaches in the United States, and the production in Georgia, North Carolina, and South Carolina, and the average prices to Georgia producers; the weekly arrivals, storage movements (1924, 1925, and 1927), and prices of peaches in New York City, June to August, inclusive, for the years 1923–1927; and the daily arrivals and prices of peaches from different States and of different varieties for different periods, 1924 and 1925. Data regarding actual returns to growers, movements into and out of storage, and the composition of the supply by size and variety were obtained from the records of commission firms and receivers.

The correlation between United States production and average price to farmers, 1910–1926 (omitting 1916–1920), gave a coefficient of correlation of −0.96 and a regression coefficient of −0.77. The regression formula is

$$\text{Log}\left(\frac{\text{Farm price}}{\text{Wholesale price index}}\right)=3.529-0.774 \text{ log production},$$

where price is stated in cents, production in millions of bushels, and the price index is the all-commodity index of the Bureau of Labor Statistics, converted to 1913 basis.

The analysis of the data showed among other things the following: Large crops ordinarily bring slightly more gross returns to producers as a whole than do small crops. Prices often fluctuate more widely within a season than from one season to the next. There is an inverse relationship between arrivals and prices. Price fluctuations from day to day within a week of as much as 50 to 75 cts. per crate are not unusual. The relative market strength of the days of the week in percentages of the average daily supply for the week were found to be Monday 145, Tuesday 91, Wednesday 81, Thursday 95, Friday 101, and Saturday 87. Prices dropped sharply with excessive supplies. Above arrivals of about 100 cars a day, adjusted for daily variation, gross value of sales does not increase. Net returns decrease when arrivals are above 85 to 90 cars per day. Different varieties vary considerably in price. If the unloads of the Belle peach exceed much more than one-fifth of the unloads of the Elberta peach, the former usually sells at a marked discount. On an average, the 2 by 1 by 6 size of Elberta peaches sells for a premium of from 7 to 12 per cent over, and the 2 by 3 by 6 size at a discount of from 10 to 15 per cent below, the 2 by 2 by 6 size. In 1924 a supply of 88 cars of each of the three sizes gave the grower the following gross returns per crate; 2 by 3 by 6 size 70 cts., 2 by 2 by 6 size $1, and 2 by 1 by 6 size $1.25. The confusion with regard to quality of New Jersey peaches results in difficulty in selling and probably accounts in part for the fact that the commission charges are about 10 per cent,

as compared with 7 to 8 per cent for Georgia peaches. In the New York market there is a decided preference for peaches in crates over those in bushel baskets, the average differential in 1924 being 37 cts. per package.

Purebred Hereford prices, 1883–1928, O. S. WILHAM ([*Oklahoma*] *Panhandle Sta., Panhandle Bul. 5 (1929), pp. 3–6*).—Using prices quoted in the *Breeder's Gazette* and the *American Hereford Journal*, tables are compiled showing the number of sales and average prices by years, 1883–1928, and the number and average prices of bulls and cows, 1887–1928.

Crops and Markets, [May, 1929] (*U. S. Dept. Agr., Crops and Markets, 6 (1929), No. 5, pp. 161–192, figs. 3*).—Included are tables, graphs, notes, reports, and summaries of the usual types and special tables showing the index numbers (1912–1914=100) for the values of farm real estate per acre, by States, 1920, and on March 1 of each of the years 1925–1929, and the cold storage holdings, May 1, 1929, for different commodities and by geographic divisions.

[Yearbook statistics] (*U. S. Dept. Agr. Yearbook 1928, pp. 666–1119*).—Current statistics and summaries as noted for the previous year (E. S. R., 59, p. 486) are given for grains, fruits and vegetables, field crops other than grain, farm animals and animal products, dairy and poultry, and foreign trade in agricultural products. Miscellaneous statistics are also included on crop acreages and yields, farm returns, cost of production of different crops, farm prices of crops and products, farm wages, farm real estate values and changes in ownership, bankruptcies of farmers, land utilization, tenure, marketing and purchasing associations, population, refrigerated space, freight tonnage and rates, fertilizers, roads, national forests, etc. Meteorological data are also given.

Agricultural maps, O. E. BAKER (*U. S. Dept. Agr. Yearbook 1928, pp. 640–665, figs. 30*).—This is a series of 30 maps, consisting of 1 map showing the agricultural regions of the United States and 29 dot maps based on the 1925 agricultural census showing the land in harvested crops, 1924; acreage of different crops, 1924; production of cotton, 1924; number of fruit trees of different kinds and of grapevines, 1924; number of tractors on farms, January 1, 1925; number of cows milked on farms, 1924; and the number of livestock of different kinds and of chickens on farms, January 1, 1925.

Agriculture in the United States (*U. S. Dept. Agr., 1929, pp. VI + 95, figs. 93*).—This is a special report prepared to supplement the exhibit of the U. S. Department of Agriculture at the Ibero-American Exposition at Seville, Spain. Various field crops, farm animals and animal products, roads and transportation, the agricultural colleges and experiment stations, and coopertive extension work are among the topics discussed.

Developmental study of a rural-urban trade area, H. W. MUMFORD, C. L. STEWART, H. C. M. CASE, and P. E. JOHNSTON (*Illinois Sta. Bul. 326 (1929), pp. 129–208, figs. 11*).—This bulletin reports a study financed by the Moline Association of Commerce of the production and marketing of farm products grown in, and the month to month consumption of such products grown within or shipped into, the trade area centering in Rock Island, Moline, East Moline, and Silvis, Ill., and to some extent in Davenport and other points in eastern Iowa. Data in the possession of the station and from the United States census and other agencies were used, and additional data were collected from consumers, dealers, transportation agencies, farmers, and others; from farmers' accounts, from questionnaires filled in by teachers and pupils of rural schools, and from special schedules filled in by special field workers. These special schedules covered consumers' demands for farm products; inbound and outbound shipments of farm products by different types of transportation agencies; availability and use of warehouse facilities for farm products; volume, quality, condition, etc., of farm products handled by wholesale and retail dealers; mar-

keting of such products through roadside stands; and the monthly payments to employees of industrial concerns in the trade area.

The trade area, the inbound and outbound shipments of farm products, farm purchases and sales of farm products, farm earnings, the organization and operation of typical farms, and home equipment on farms in the area are described and discussed. The production and consumption of field crops, meat animals, dairy products, poultry and eggs, fruits, and potatoes and other vegetables, and transportation, price margins, cooperative shipping of livestock, and roadside markets are discussed. The opportunities for increasing or improving the present production or bettering the present situation are pointed out.

Several recommendations are made regarding (1) increasing the production of certain products so as to more nearly meet local demands, (2) educating consumers as to desirable food habits and the selection and purchase of foods on a quality basis, (3) instructing producers in the grading and packing of products and the advantages of such practices, (4) the extension of local and State projects looking to more efficient and better balanced farm production, (5) the encouragement of 4-H Club work and instruction in agriculture and home economics in high schools, and (6) the organization of a joint committee from local farm, business, and civic organizations to formulate and put into effect a local developmental program.

The county library in Montana, J. W. Barger (*Montana Sta. Bul. 219 (1929), pp. 54, figs. 10*).—This bulletin is based upon a questionnaire sent to the librarian of each of the 9 county libraries of the State, correspondence with patrons, branch librarians, and others, and personal visits to 8 of the county libraries and their branches and book stations. The legislation pertaining to, and the history and present status of, county libraries in the State are described, and the financing and operation of the libraries, the uses made of the different libraries, and the attitude of different classes of people toward the system are discussed.

The 9 county libraries maintained 5 branch libraries and 356 book stations, of which 232 served school pupils only and 45 others were located in schoolhouses. The number of books owned per library ranged from 2,830 to 18,000. Of the total number of books, 43.6 per cent were fiction, 28.5 per cent reference, and 27.9 per cent juvenile. The approximate number of books added during 1927 varied from 347 to 1,550 per library, averaging 855. The libraries estimated that from 10.2 to 60.2 per cent, averaging 35.2 per cent, of the population of the several counties were registered as borrowers; that from 35 to 70 per cent, averaging 50.2 per cent, of the borrowers were young people; and that 42.5 per cent of the borrowers lived in the country. The annual circulation of books by the several libraries varied from 3.6 to 22.9 per cent, averaging 11.9 per cent, per borrower, and from 1.38 to 6.58, averaging 3.62, per capita of total population of the several counties.

The average total annual expenditures for library support in the different counties for the period that each has had a library ranged from $1,263.67 to $7,506.97, and the average annual tax levy for library purposes from 0.25 to 0.91 mill. The expenditures in 1927 per capita of total population ranged from 19.92 cts. to $1.0018, averaging 45.59 cts. Of the total expenditures in the several counties, 37 to 64 per cent, averaging 51 per cent, was for salaries; 0 to 27 cent, averaging 16 per cent, for new reading matter; and from 20 to 48 per cent, averaging 33 per cent, for operation and maintenance.

This study was made in cooperation with the U. S. D. A. Bureau of Agricultural Economics.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

A history of agricultural education in the United States, 1785–1925, A. C. TRUE (*U. S. Dept. Agr., Misc. Pub. 36 (1929), pp. IX+436, pl. 1, figs. 25*).—This monograph is noted editorially on page 401.

Introduction to American economic history, W. W. JENNINGS (*New York: Thomas Y. Crowell Co., 1928, pp. XII + 546, pls. 4, figs. 100*).—This is a briefer and more simplified work than that previously noted (E. S. R., 56, p. 187), and is intended for junior college work. The subject is treated by topics.

Strawberry club manual, A. S. COLBY (*Illinois Sta. Circ. 339 (1929), pp. 32, figs. 17*).—The principles underlying successful strawberry culture are outlined for boys' and girls' strawberry club members.

Nature in farming, J. W. PATERSON (*Perth, West. Aust.; Fred. Wm. Simpson, Govt. Prtr., 1929, 3. ed., pp. XIV + 226, figs. 137*).—This is the third edition of the text previously noted (E. S. R., 50, p. 94).

FOODS—HUMAN NUTRITION

Food consumption of farm families in Ohio, H. MCKAY (*Ohio Sta. Bul. 431 (1929), pp. 128, 129*).—Food consumption records kept by the account-book method for 47 rural families for the year ended January, 1927, were analyzed for adequacy by individual families and in general averages for the entire group. In the compilations the double dietary scale recommended by Hawley was used, and the values were compared with the Sherman standards of 3,300 calories, 74 gm. protein, 0.75 gm. calcium, 1.45 gm. phosphorus, and 0.0165 gm. iron, these values allowing 10 per cent for waste.

For 20 families the diet was adequate in all factors, for 6 inadequate in every factor, for 12 inadequate in protein, 12 in calcium, 19 in total calories, 23 in phosphorus, and 27 in iron. Calculated values for the entire group per male adult unit compared favorably with unpublished data from a similar study made by the survey method.

Seasonal growth of pre-school children, H. MCKAY (*Ohio Sta. Bul. 431 (1929), pp. 129–131*).—This progress report is based upon the records of 44 preschool children for whom height and weight records were obtained every month from May, 1927, to May, 1928, together with information on the dietary and health habits of the children and on weather conditions in Columbus, Ohio, where the study was conducted.

Of the entire 44 children, 23 made or exceeded the expected gains in weight and 31 in height. More than half of those who made less than the expected gains in weight exceeded the expected gains in height by from 4 to 30 per cent. The greatest gains in both weight and height were made over the period from May through October. The average gains in weight per month per child were 0.48 lb. for this period and 0.24 lb. for the November to April period. In height the average gains in the two periods were 0.26 and 0.21 in., respectively.

In discussing the factors influencing these results it is pointed out that the foods varied little between the two seasons as far as kind and quantity were concerned, but that the quality of such foods as fruits, vegetables, eggs, and milk might have been superior during the summer months. The time spent in rest varied little from season to season, but the time spent out of doors was much longer during the summer than the winter months. This fact, together with the greater amount of sunshine during this period, is thought to account chiefly for the greater gains. Illnesses were more frequent during the winter period, particularly during February, March, and April, 1928.

Good food habits for children, C. R. SCHMIDT (*U. S. Dept. Agr. Leaflet 42* (*1929*), *pp. 8, figs. 7*).—A popular discussion, based upon research in child psychology, of methods of building good food habits and of correcting faulty habits in children. Regularity of meals, attractiveness of food, the serving of small portions, the encouragement of self-help, and safeguarding the appetite are among the methods suggested for forming good habits. Problems included under faulty habits are upset appetites, refusal of food in order to be in the limelight, dawdling, and chronic refusal of food.

It is emphasized in conclusion that the parents' job in training in food habits is only half done when it is well begun, since new problems may develop at any time until the child is grown up. "Parents should, therefore, continue to supervise the child's eating as he is growing up. Good food habits make for good nutrition, and good nutrition is in turn the basis for sound physical development."

The influence of diet on teeth, A. F. MORGAN (*West. Hosp. and Nurses' Rev.*, *12* (*1929*), *No. 5, pp. 19–21, 46*).—A review of recent literature with a discussion of the relation between the acid-base equilibrium of the diet and the body and the development of normal bones and teeth.

In the opinion of the author "the teachings as to the dangers of 'acidosis' undoubtedly have experimental basis in certain directions, as for instance in the treatment of nephritis, but lack support in others, particularly in regard to the bone metabolism. It seems especially unfortunate that adequate distinction is not always noted between the reaction of the diet as expressed in cubic centimeters of normal solution and the proportion of the important bone-building elements, calcium and phosphorus, present. A diet showing the same amount of excess base might well be calcium low for instance, or on the other hand calcium high, with quite different results in the nutrition of young children. Again a diet of identical calcium content might be rendered acid or basic by adventitious amounts of other elements and thus made more or less valuable for bone development."

The Calavo in the diet, L. S. WEATHERBY (*West. Hosp. and Nurses' Rev.*, *12* (*1929*), *No. 5, pp. 31–33, figs. 2*).—This is a comparison of the Calavo (California avocado) with other fruits as to energy value, proximate analysis, and content of vitamins, with the conclusion that "it ranks first among fresh fruits in calorific value, in protein content, and in the necessary mineral elements. It has been shown also that it is of high importance for its vitamin value. It is apparent, therefore, that beside the appetizing appeal of its rich nutty flavor, the Calavo holds an important place as a food on account of its dietary value."

Studies on the nutritive value of milk, I, II, W. E. KRAUSS (*Jour. Dairy Sci.*, *12* (*1929*), *Nos. 1, pp. 74–79, fig. 1; 3, pp. 242–251, figs. 5*).—This is a contribution from the Ohio Experiment Station.

I. *The production of nutritional anemia in albino rats through exclusive whole milk diets.*—A procedure similar to that of Waddell et al. (E. S. R., 59, p. 892) is described for the production of anemia in rats on an exclusive milk diet. In studies of the effect of various food substances in nutritional anemia thus produced, the authors have used both preventive and curative tests. It is noted that of the various substances tested the only success has been attained through the use of a specially prepared yeast, hog liver, or solutions of iron and copper fed simultaneously.

II. *The supplementary value of inorganic iron and copper.*—Systematic attempts to find a supplement which, in very small quantities, would prevent nutritional anemia in rats on an exclusive milk diet are reported.

Before the publication of the paper by Hart et al. (E. S. R., 59, p. 893), in which the value of copper as a supplement to iron was demonstrated, ferrous

sulfate, ferric citrate, ferric chloride, and colloidal ferric oxide had been tested and found ineffective. Following the suggestion of Hart et al., copper sulfate given in 0.16 mg. daily amounts proved effective in the regeneration of hemoglobin when administered either as a supplement to the iron or alone. The ability of copper alone to stimulate hemoglobin regeneration is thought to indicate that there is as serious a deficiency of copper as of iron in milk, that the availability of the iron is more important than the amount present, and that iron is made more available through the addition of copper.

The nutritional value of copper in powdered whole milk, R. W. Titus and J. S. Hughes (*Jour. Dairy Sci., 12 (1929), No. 1, pp. 90–93, fig. 1*).—Data are presented showing that whole milk powder which has had its copper content increased by condensation in a copper vacuum pan is capable of preventing nutritional anemia in rats when fed with a supplement of iron, but not when the iron is omitted.

The mineral constituents of cranberries, F. W. Morse (*Jour. Biol. Chem., 81 (1929), No. 1, pp. 77–79*).—Supplementing the study of the iodine content of cranberries (E. S. R., 60, p. 687), data are reported on the mineral constituents and alkalinity of the ash of fruit representing the 1925 crop. The fresh cranberries were found to contain 88.44 per cent of water and 0.158 per cent of ash. The composition of the ash in terms of the fresh material was potassium oxide 0.068, sodium oxide 0.003, calcium oxide 0.018, magnesium oxide 0.009, phosphorus pentoxide 0.019, sulfur 0.005, chlorine 0.004, iron 0.00022, and manganese 0.00057 per cent. In comparison with figures reported by Lindow and Peterson on the manganese content of various food materials (E. S. R., 58, p. 290), cranberries appear to be comparatively high in this element.

The alkalinity of the ash varied from 1.9 to 2.4, with an average of 2.2, cc. of normal alkali required by the ash from 100 gm. of fresh berries.

The alleged presence of carotin in pig's liver, L. S. Palmer (*Amer. Jour. Physiol., 87 (1929), No. 3, pp. 553–557, fig. 1*).—A quantitative examination of the carotin-like pigment in pig's liver was undertaken to answer the disputed question of the presence of carotin in pig's liver, thought by Underhill and Mendel (E. S. R., 59, p. 394) to be capable of curing a dietary deficiency canine disease similar to pellagra. There was isolated from pig's liver a minute quantity of a nonsaponifiable petroleum-ether soluble pigment which resembled carotin in solubility and adsorption properties and gave some color reactions similar to those given by the carotinoids. The pure pigment differed from carotin, however, in its greater stability to bleaching and in its spectroscopic properties, which were qualitatively and quantitatively totally unlike carotin.

"These results make it evident that some other explanation is required for the same effects of carotin crystals, carrots, and pig's liver in the canine syndrome studied by Underhill and Mendel. The liver effects can not be due to carotin. As Underhill and Mendel themselves suggest, but reject in their conclusions, their carotin crystals evidently carried some as yet unidentified substance or substances which were the effective agents."

Studies in human physiology.—I, The metabolism and body temperature (oral) under basal conditions, F. R. Griffith, jr., G. W. Pucher, K. A. Brownell, J. D. Klein, and M. E. Carmer (*Amer. Jour. Physiol., 87 (1929), No. 3, pp. 602–632, figs. 3*).—This is the first of a series of papers reporting the metabolism under varying conditions of five normal human subjects, two male and three female, the former being under continuous observation for two years and the latter for one. The subjects were from 19 to 35 years of age and were instructors, students, or laboratory technicians in a medical school. The primary purpose of the study was to determine what constancy or variation in the metabolism of normal persons living under normal conditions might be

expected as the result of various functions. The data obtained, subjected to statistical analysis for accuracy, have led to the following general conclusions:

There was no significant correlation between the variations of temperature and metabolism, weight and metabolism, or protein and total metabolism, and a negative correlation between temperature and metabolic rate.

Average and extreme variations for duplicate, day-to-day, and yearly determinations of oxygen consumption showed the women to be in all respects more variable than the men. Of the two subjects who were able to sleep during the observations, sleeping either lightly or soundly had no effect with one and a negligible effect (decrease) on the total oxygen, carbon dioxide, and respiratory quotient of another. Vacations, even when spent on a 10-day canoe trip with much tanning, did not appear to affect the metabolism.

In all of the three female subjects the nitrogen metabolism was lowest during menstruation and highest in the second or third week following. The total metabolism was higher during the third or fourth week following menstruation. In two of the subjects the lowest metabolism was in the first or second week after menstruation, and in the third subject at the time of menstruation.

Although seasonal changes were apparent, these varied with the different subjects. "Neither the protein nor the nonprotein fractions, taken separately, nor the carbon dioxide excretion show concurrent seasonal variations with the different subjects. The total oxygen consumption and calories per square meter (Du Bois formula) show roughly concurrent variations in four of the subjects, with minima in the late summer or early fall; in one of these there is also a marked depression in the spring; and, in the fifth, this spring depression is much the most pronounced. The respiratory quotient also shows a seasonal change, being higher during the summer or fall, with four of the subjects than during the colder parts of the year; but the fifth subject is quite anomalous, and, among the four, there is the same lack of exact correspondence which characterized the oxygen consumption. The divergent incidence of these effects in these subjects, as well as the divergent reports in the literature, suggest the hypothesis that the metabolism is not directly affected by the climate, but is only indirectly related to it by reason of habits and activities, which, in a homogeneous group, might be expected to have an approximate seasonal concurrence. Our notes are not full enough to suggest anything more definite by way of conclusion."

Basal metabolism of young women, H. McKay (*Ohio Sta. Bul. 431 (1929), pp. 131, 132*).—In this progress report (E. S. R., 59, p. 288), new data are summarized by ages on the average energy production of girls from 14 to 18 years of age, covering 205 observations on 77 subjects. For each of the age groups from 15 to 18, inclusive, it is thought that enough observations have been made to warrant tentative conclusions.

With the exception of the 17-year-old group the calories per square meter decreased steadily with age, and by every method of comparison except that of calories per 24 hours the energy values of the 18-year-old group were lower than the 14-year group. It is concluded that the slowing up of the metabolic rate reported by other observers for the ages of 12 to 14, inclusive, also continues in a fairly regular way through the ages of 15 to 18. The average results were higher than corresponding values reported by Benedict for girls at sleep, but lower than the Du Bois standards for the corresponding ages.

Tissue changes associated with vitamin A deficiency in the rat, M. D. Tyson and A. H. Smith (*Amer. Jour. Path., 5 (1929), No. 1, pp. 57–70, pls. 2*).—This investigation differs from previous ones on the same subject in that special attention was paid to the rôle of infection in the early stages of the

vitamin deficiency and to the order in which the lesions appear in various parts of the body and disappear following corrective measures.

Rats from the same litters were distributed into four groups, (1) to be observed early in the course of the experiment, (2) to be allowed to develop marked vitamin A deficiency or to die from it, (3) to be placed on corrective diet after symptoms of deficiency developed, and (4) to serve as positive controls. Histological studies were made at appointed times on the accessory salivary glands at the base of the tongue, submaxillary glands, trachea and bronchi, and renal pelvis, the base of the tongue receiving special attention.

The rats on the deficient diet grew steadily for a time, but at a lower rate than the controls. Xerophthalmia appeared in from 27 to 50 days, the average being 40 days. There was no uniformity in its appearance with relation to loss in weight. Sometimes the eye changes were evident before there was any loss of weight, in other cases several grams of body weight would be lost before the eye changes were noticeable, and in some instances the maximum weight was not reached until several days after the onset of xerophthalmia. The most customary sequence was the appearance of xerophthalmia after two or three days of stationary weight, and then rapid loss in weight.

None of the animals in group 1 showed gross lesions on autopsy. In group 2 all of the animals had varying degrees of xerophthalmia, all were much emaciated, and all had abscesses at the back of the tongue from which pus could be expressed. Atrophy of the submaxillary glands with abscess formation and urinary calculi were observed in some but not all of this group. In the animals of group 3 the response to cod-liver oil was rapid, as a rule, although some were too far gone to respond. The xerophthalmia cleared before the tongue lesions. The controls gained weight rapidly and showed no evidence of disease even after as long a time as 144 days.

The order in which the degenerative processes appeared as determined by histological examination was sublingual glands, submaxillary glands, and the epithelium of the renal pelvis, trachea, and bronchi. The tongue was regularly involved before xerophthalmia appeared. The submaxillary gland was not involved as constantly as the tongue. The epithelium of the renal pelvis was sometimes involved quite early. Hyperplasia was striking in the tongue and renal pelvis, but not common in the trachea and bronchi. Infection was universally present, and in the more severe cases dominated the picture.

Following corrective dietary treatment the xerophthalmia healed more quickly than the other lesions. Abnormal conditions of the epithelium and chronic or acute infection persisted in the tongue and renal pelvis after the rat outwardly appeared healthy.

The vitamin content of milk used in infant feeding, I. G. Macy and J. Outhouse (*Amer. Jour. Diseases Children, 37 (1929), No. 2, pp. 379–400*).—This critical discussion of the value with respect to the content of vitamins A, B, and D of cow's milk and human milk in infant feeding is based upon the literature dealing with experimental and clinical demonstrations of the effects of dietaries low or deficient in vitamins, and upon the series of studies conducted by the authors on the vitamin content of cow's milk and human milk (E. S. R., 59, p. 690).

These studies have shown that average human milk contains approximately the same amount of vitamin A as cow's milk, but only about one-half as much vitamin B. Cow's milk contains a small amount of vitamin D and human milk practically none. It is pointed out, however, that although cow's milk is somewhat richer in vitamins than human milk its superiority in this respect is easily lost in the modifications usually employed, either through dilution or oxidation, or by lessened utilization. The fact that in spite of the many ways

in which the infant may fail to receive or utilize its quota of vitamins it may grow and develop satisfactorily when fed either breast milk or cow's milk is attributed to the satisfactory dietary of the mother during pregnancy and the quantity and quality of the milk.

In the opinion of the authors, "the adherence of women throughout pregnancy and lactation to dietaries rich in fruit, vegetables, dairy products, glandular tissues, and the like, together with the early presentation of vitamin-carrying foods to the infant, serve as the most potent factors in the production of the nutritionally stable child."

Human milk and vitamin A (*Jour. Amer. Med. Assoc., 92 (1929), No. 16, pp. 1352, 1353*).—Editorial discussion is here given of the papers of Macy and Outhouse and Tyson and Smith, noted above, and of a previous paper by Sherman and MacLeod (E. S. R., 54, p. 488). In conclusion, the suggestion is made that "the extension of the use of orange juice and of cod-liver oil to the feeding program of breast-fed infants would provide a better defense against any known dietary deficiency."

The vitamin A, B, and C content of artificially versus naturally ripened tomatoes, M. C. House, P. M. Nelson, and E. S. Haber (*Jour. Biol. Chem., 81 (1929), No. 3, pp. 495–504, figs. 2*).—A quantitative comparison of green, air-ripened, ethylene-ripened, and vine-ripened tomatoes as sources of vitamins A, B, and C is reported with the conclusion that the vitamin B content of green tomatoes does not change on ripening by any of the three methods; that ripe tomatoes are richer than green in vitamin A, but that the method of ripening is immaterial; that green tomatoes contain relatively little vitamin C; and that more of this vitamin is found in fruit ripened on the vines than in the air-ripened or ethylene-ripened fruit. The commercial method of ripening tomatoes in an ethylene-air mixture thus appears as desirable in respect to the content of vitamins A, B, and C as picking green and allowing to ripen in the air, but not as desirable from the standpoint of vitamin C as allowing the fruit to ripen on the vine.

The association of vitamin A with greenness in plant tissue.—II, The vitamin A content of asparagus, J. W. Crist and M. Dye (*Jour. Biol. Chem., 81 (1929), pp. 525–532, figs. 3*).—Continuing the investigation previously noted (E. S. R., 57, p. 895), the authors have found that green asparagus, whether raw, freshly cooked, or canned, contains sufficient vitamin A to promote health and growth of albino rats at a satisfactory rate when fed daily at the rate of 0.1 gm. per rat, but that fresh bleached asparagus in 0.1 and 0.5 gm. daily doses contains no appreciable amount of vitamin A. These results are in accord with the earlier ones on lettuce, showing a positive relationship between chlorophyll development and vitamin A content. In commenting on this the authors state: "Whether or not this association is unalterably one of cause and effect is a question still to be answered, and probably hinges upon the experimental task of procuring plant tissue which is nongreen and yet whose chemical composition is not such as to introduce factors which complicate the results."

The asparagus used was of the Martha Washington variety, grown in the college gardens. Bleaching was secured by covering over the rows with about 4 in. of soil and cutting the stalks just before they emerged from the soil. Although the bleached asparagus showed no appreciable vitamin A, slightly better results were obtained with it cooked than raw, thus suggesting the presence in the bleached material of harmful substances which were rendered harmless by cooking. The green asparagus had lower percentages of water and iron than the bleached, but higher percentages of ash, nitrogen, sulfur, calcium, phosphorus, and possibly manganese.

Vitamin content of treated tomatoes and asparagus (*Jour. Amer. Med. Assoc., 92 (1929), No. 14, pp. 1183, 1184*).—Editorial comment on the studies by House, Nelson, and Haber, and by Crist and Dye (above noted).

The nervous system in rats fed on diets deficient in vitamins B_1 and B_2, R. O. Stern and G. M. Findlay (*Jour. Path. and Bact., 32 (1929), No. 1, pp. 63–69, pl. 1*).—An examination of the nervous system of rats suffering from deficiency in vitamins F (B_1) and G (B_2) singly and combined (E. S. R., 60, p. 493) has revealed a striking similarity between the nervous lesions of rats on diets lacking only in vitamin G and those reported in the literature for human pellagra. These are described as "swelling and vacuolation of the anterior horn cells of the spinal cord with the deposition in them of lipochrome pigment, a noticeable increase in the surrounding satellite cells, and an increase in the number of π granules in the peripheral nerves."

Rats on a diet deficient in both F and G showed only slight chromatolytic changes in the ganglion cells of the spinal cord, and those on a diet deficient only in vitamin F, the same changes, but to a greater extent and, in cases of paralysis of long standing, early degeneration in the myelin of the peripheral nerves.

Avitaminosis in relation to disease resistance, R. L. Jones (*Amer. Med., n. ser., 23 (1928), No. 12, pp. 961–968*).—In this literature review the author classifies diseases which may be attributable directly or indirectly to vitamin deficiency as (1) of direct dietary origin, (2) those involving impaired metabolic function but not directly attributable to faulty nutrition, and (3) infectious diseases.

Under the first group are placed the so-called deficiency diseases; under the second, alterations in blood pressure and respiratory quotients, gastrointestinal disorders, anemias, etc.; and under the third, diseases of bacterial origin.

Comparison of the antirachitic potency of ergosterol irradiated by ultra-violet light and by exposure to cathode rays, A. Knudson and C. N. Moore (*Jour. Biol. Chem., 81 (1929), No. 1, pp. 49–64, pl. 1*).—A comparison of cathode and ultra-violet rays for inducing antirachitic activity in ergosterol (E. S. R., 57, p. 793) is reported with the following results:

The highest antirachitic potency as determined by biological tests obtainable by cathode ray exposure was 0.0005 mg. per day and by ultra-violet irradiation 0.00002 mg. The changes in absorption spectra, however, were similar following exposure to cathode and ultra-violet rays. Yeast cholesterol and ergosterol were not rendered antirachitic by exposure to cathode rays behind a quartz plate, thus showing that the antirachitic properties produced by cathode rays are not due to the production of ultra-violet rays.

During the course of the investigation it was established that marked antirachitic properties could be produced in ergosterol by exposure to ultra-violet light for 1 second and that exposure for 300 minutes destroyed the antirachitic properties. Exposure for 15 seconds or for 3 minutes gave products of somewhat higher activity than exposure for 30 minutes.

The tetany of fasting in experimental rickets, T. S. Wilder (*Jour. Biol. Chem., 81 (1929), No. 1, pp. 65–72*).—The author has repeated and confirmed the work of Cavins (E. S. R., 51, p. 567), demonstrating that fasting of rachitic rats produces in the first 24 to 36 hours a marked rise in the inorganic phosphate of the blood accompanied by severe tetany, and in addition has shown that the increase in plasma inorganic phosphate is not derived from the other phosphorus factors in the blood, but is undoubtedly due to destruction of the body protoplasm. The phosphate thus released is retained for deposition in the healing

bones. Blood sugar determinations showed that the convulsions can not be attributed to hypoglycemia.

Calcium and phosphorus metabolism in artificially fed infants.—I, Influence of cod liver oil and irradiated milk, A. L. Daniels, G. Stearns, and M. K. Hutton (*Amer. Jour. Diseases Children, 37 (1929), No. 2, pp. 296–310*).—The feeding mixtures studied in this investigation of the influence of different types of artificial feeding mixtures on the retention of calcium and phosphorus included simple dilutions of cow's milk with added dextrimaltose or lactose, sterilized by pasteurization by the holding process in individual bottles or by the quick boiling method. In the present study the influence of added cod-liver oil and irradiated olive oil and of irradiating the milk have been tested by metabolism studies conducted as described in a previous paper (E. S. R., 52, p. 764). The results of 74 metabolism studies have been tabulated according to the treatment of the feeding mixtures and according to the average creatinine output of the infants in the various groups. The retention values for calcium and phosphorus were recorded for each child on the basis of weight.

The phosphorus content of the feces of infants receiving pasteurized and boiled milk without any addition was much higher than of those receiving supplements of cod-liver oil. Irradiated milk gave results similar to those with cod-liver oil, while the fecal phosphorus following the use of irradiated olive oil was lowest of all. The percentages of phosphorus excreted in the urine varied only slightly in the different groups, thus making the retention of phosphorus inversely proportional to the fecal output.

The amount of calcium eliminated appeared to be influenced both by the method of sterilizing the feeding mixture and by its antirachitic potency, the latter having the greater influence. The elimination in the urine was small and fairly comparable in all the groups. The lowest retentions were in the pasteurized milk. The addition of cod-liver oil or the use of irradiated milk increased the amount of calcium retained, but the averages were lower in all cases than in the corresponding groups receiving boiled in place of pasteurized milk.

The calcium-phosphorus ratios differed widely. With few exceptions, the retention ratios on the pasteurized milk were very low, averaging 0.5. On boiled milk the average was 1.2. The average ratios of two groups receiving pasteurized milk and cod-liver oil were 0.8 and 1, and of boiled milk and cod-liver oil 1.2 and 1.48. Consistently high ratios were obtained with irradiated milk and with supplements of irradiated olive oil, the average values being 2 and 1.48, respectively. A ratio of 2 is considered optimum for infants under 1 year of age.

The authors conclude that rickets is probably related to an imbalance in the amount of calcium and phosphorus retained. Since a high percentage of phosphorus in stools of infants receiving feedings of cow's milk has been shown to be correlated with a low absorption of calcium, it is suggested that early metabolic disturbances incident to the development of rickets in infants receiving modifications of cow's milk may be detected by determining the percentages of ingested phosphorus in the urine and feces.

Pellagra, J. Goldberger (*Jour. Amer. Dietet. Assoc., 4 (1929), No. 4, pp. 221–227*).—A general discussion of the symptoms, etiology, and occurrence of this disease, with special emphasis on the influence of economic conditions, as suggested in a previous paper (E. S. R., 59, p. 295).

TEXTILES AND CLOTHING

***Stiffness in fabrics produced by different starches and starch mixtures* and a quantitative method for evaluating stiffness,** E. C. PETERSON and T. DANTZIG (*U. S. Dept. Agr., Tech. Bul. 108 (1929), pp. 30, figs. 9*).—The abilities of the starches of wheat, rice, corn, and potatoes to produce stiffness in a cotton fabric were determined and a physical method devised for measuring the stiffness of materials.

In general the wheat starch produced the stiffest fabric and the potato the least stiff, whereas the corn and rice gave practically the same effect. It was noted that the same kind of starch from different sources may show different stiffening properties. Three different stiffness values were obtained for four samples of cornstarch from different sources. Varying the time of heating the starch paste from 5 to 60 minutes did not affect appreciably the stiffness of the sized fabric as measured in the laboratory.

Dilution of the standard paste produced a gradual decrease in the resulting stiffness of the fabrics sized with wheat, corn, and rice starches, while with potato starch it was necessary to reduce the concentration about 17 per cent of the original (3.7 per cent to 3.06 per cent) before any decrease in the fabric stiffness became apparent. Addition of borax increased the stiffening power of cornstarch until a maximum of 20 per cent compared to the weight of the starch had been reached, when came a decrease in the stiffening power. Salt, paraffin, beeswax, and hydrogenated vegetable oil up to 27 per cent of the weight of starch did not affect appreciably the stiffness of fabrics sized with cornstarch.

In the mathematical development of a quantitative measure of stiffness, projected strips of starched fabrics falling under their own weight were found to follow elastic laws and assume a curve given by the formua for the quartic parabola $\bar{y} = -\frac{\omega}{4l^3}\bar{x}^4$, where x and y are the coordinates when the vertex of the parabola is at the free end of the projected strip and the x and y axes are the tangent and normal, respectively, at the free end. From the elastic curve it was deduced that the stiffness of the projected strip is proportional to the cube root of the elastic modulus and to the length of the radius vector as given by equations.

Where sheets wear out, R. O'BRIEN and J. STEELE (*Textile World, 75 (1929), No. 15, pp. 69, 103, figs. 2*).—Through the courtesy of the management of a women's hotel in Washington, D. C., a study was made at the Bureau of Home Economics, U. S. D. A., of the areas of greatest wear in 400 sheets discarded by the hotel during a period of 11 months. The sheets had been laundered regularly in the hotel laundry and examined and repaired when necessary after each laundering. In examining the sheets a diagram of wear areas and folds was made and a chart, based on this diagram, was used for recording the data from each sheet according to predetermined classification of types of wear.

The tabulated results showed over twice as much wear due to breakage of filling yarns as the warp yarns, almost eight times as many breaks along the center fold as the left or right folds although the sheets were folded by hand and not in ironing, and more wear on the selvages than on the hemmed edges. The area of greatest wear was the region of the shoulders.

In general the same types and areas of wear were found in a smaller number of sheets available from the Washington branch of the Young Men's Christian Association.

MISCELLANEOUS

Yearbook of Agriculture, 1928, W. M. Jardine et al. (*U. S. Dept. Agr. Yearbook 1928, pp. V+1145, figs. 280*).—This contains the report of the Secretary of Agriculture, nearly 300 brief articles arranged alphabetically by subjects and discussing recent developments under the general title of What's New in Agriculture, a list classified by general subject matter of the Department publications of the calendar year 1928, a series of agricultural maps noted on page 487, and the usual statistics noted on page 487.

Fortieth Annual Report of the Kentucky Agricultural Experiment Station for the year 1927, Part II (*Kentucky Sta. Rpt. 1927, pt. 2, pp. [2]+343+49+[2], figs. 47*).—This contains reprints of Bulletins 277–282 and Circulars 36–38, all of which have been previously noted.

[Fortieth Annual Report of the Michigan Station, 1927], R. S. Shaw et al. (*Michigan Sta. Rpt. 1927, pp. 261–376, figs. 19*).—This report contains a financial statement for the year ended June 30, 1927, and reports of the director and heads of departments on the work of the station during the year, the experimental features of which are for the most part abstracted elsewhere in this issue. Analyses of vinegars are also included (p. 310).

Report [of] Raymond Branch Experiment Station, 1928, H. F. Wallace and J. L. Cooley, jr. (*Mississippi Sta. Bul. 262 (1928), pp. 40, fig. 1.*)—The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of Holly Springs Branch Experiment Station, 1928, C. T. Ames and O. B. Casanova (*Mississippi Sta. Bul. 264 (1928), pp. 42, figs. 9*).—The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the South Mississippi Branch Experiment Station for 1928, W. R. Perkins, W. S. Anderson, and W. W. Welborne (*Mississippi Sta. Bul. 266 (1928), pp. 38*).—The experimental work reported is for the most part abstracted elsewhere in this issue.

Forty-seventh Annual Report of [Ohio Station], 1928, C. G. Williams et al. (*Ohio Sta. Bul. 431 (1929), pp. 180, figs. 25*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1928, and a report of the director summarizing the work of the station during the year. The experimental work reported not previously noted is for the most part abstracted elsewhere in this issue.

Michigan Agricultural Experiment Station Quarterly Bulletin, [May, 1929], edited by V. R. Gardner and A. J. Patch (*Michigan Sta. Quart. Bul. 11 (1929), No. 4, pp. 153–214, figs. 16*).—In addition to articles abstracted elsewhere in this issue, this number contains the following: Corn Varieties and Planting Dates Are Tested, by A. R. Marston (pp. 161–163); Good Rations Stop Cottonseed Meal Injury, by C. F. Huffman (pp. 164–170) (E. S. R., 61, p. 262); Foundation Cow Builds up Chatham Herd, by G. W. Putnam (pp. 178–183); and Selected Raspberry Plants Cut Disease Losses, by S. Johnston (p. 198).

The Bimonthly Bulletin, Ohio Agricultural Experiment Station, [May–June, 1929] (*Ohio Sta. Bimo. Bul. 138 (1929), pp. 65–112, figs. 8*).—In addition to several articles noted elsewhere in this issue, this number contains Genetic Tests in Animal Breeding, by B. L. Warwick (pp. 94–96).

[Miscellaneous papers from the Panhandle Station] (*[Oklahoma] Panhandle Sta., Panhandle Bul. 6 (1929), pp. 16, fig. 1*).—In addition to three articles abstracted elsewhere in this issue, this number contains one entitled The Food Value of Milk, by J. K. Muse.

NOTES

Delaware University and Station.—G. F. Gray, assistant in horticulture in the university and assistant horticulturist in the station, resigned September 1 to take up graduate work at the Michigan College, and has been succeeded by Joseph E. Vaile. M. W. Goodwin of the Massachusetts Station has been appointed assistant chemist in the station, effective September 15. J. C. Kakavas has been appointed instructor in bacteriology in the School of Agriculture vice H. R. Baker, whose resignation has been previously noted.

Florida Station.—Workers of the station were given an excellent opportunity to meet with farmers and fruit growers of the State from August 12 to 17, at which time the annual Farmers' Week was held at the College of Agriculture. More than 100 speakers were heard, and of this number 23 were full-time station employees who gave talks summarizing results of experiments which have been and are being conducted. Trips were made to the various experimental plats and the station farm which were largely attended.

Ernest G. Moore, assistant editor, has resigned effective September 15 to accept a position with the Press Service of the U. S. Department of Agriculture.

Hawaii University.—Dr. Herbert F. Bergman, professor of botany since 1919, has resigned to become senior pathologist in the U. S. D. A. Bureau of Plant Industry.

Hawaiian Pineapple Canners' Station.—Effective July 1, Dr. F. G. Krauss, geneticist, has severed his connection with the station to devote his entire attention to the agricultural extension work of the University of Hawaii. Kenneth Kerns, assistant geneticist, has been given a year's leave of absence for study at the University of California, during which time Dr. J. L. Collins, assistant professor of genetics in that university, will serve as geneticist.

The former department of botany has been divided into departments of pathology and physiology. Dr. M. B. Linford has been appointed to take charge of the work in pathology, while Dr. C. P. Sideris will retain charge of that in physiology. Gwendolyn C. Waldron has resigned as assistant pathologist. It is hoped to secure a soils specialist to head the department of chemistry, now assigned to the director.

Nevada Station.—On September 1 the department of veterinary science moved into new and enlarged quarters, half of one floor in the main agricultural building having been rebuilt to house its activities. The new accommodations will provide three private working laboratories and a serological and pathological laboratory, together with a preparation room, office, library, museum, and small experimental animal quarters.

In the future the facilities of this department are to be devoted exclusively to research and diagnostic work on diseases of livestock, including poultry. Two new projects have been started, the first of which is an intensive study of a hemorrhagic enteritis affecting turkeys of all ages, which has recently caused severe losses among turkeys. A thorough preliminary survey has failed to demonstrate any parasitic, dietetic, or other previously established cause, and it appears possible that the condition may prove to be a distinct

specific disease entity. The second project will deal with crooked breastbones and other skeletal deformities of turkeys, which cause severe economic losses through reduction in grade of the dressed carcasses at the time of marketing. An attempt will be made to determine definitely the underlying causes of the condition and work out practical means for its correction.

Texas College.—A new library building to be known as the Cushing Library and for which a State appropriation of $250,000 is available for building and equipment is under construction and is expected to be ready for occupancy July 1, 1930.

Washington College and Station.—Funds have been set aside by the board of regents for the construction of a new dairy barn at the college. The barn at present occupied by the dairy herd will be used for a horse barn.

Dr. J. R. Magness, head of the department of horticulture, has resigned effective September 1 to become principal horticulturist in charge of fruit production work of the U. S. Department of Agriculture. Dr. A. L. Hafenrichter has been appointed assistant professor of farm crops in the college and assistant in farm crops in the station and assumed his new duties June 15. Evelyn H. Roberts has been appointed research specialist in home economics in the station vice Inez Arnquist, who has been transferred to the extension service. Venona W. Swartz has been appointed research specialist in foods and nutrition in the station beginning September 16 vice Catherine Landreth, resigned to accept a scholarship to study child welfare.

Horticultural Foundation at Swarthmore College.—Gifts totaling $75,000 have recently been announced for the establishment in Swarthmore College of the Arthur H. Scott Foundation of Horticulture. These gifts were in memory of an alumnus of the college in the class of 1895. The objects of the foundation include the founding of an arboretum, the development of floriculture, and the promotion of interest in better gardens. In furtherance of this aim the campus and a tract of woods recently given the institution are to be developed along horticultural and forestry lines. A chair of horticulture is to be established, and a medal and prize of $1,000 based on a nation-wide competition are to be awarded annually for outstanding service for better gardens.

University of the Philippines.—The board of regents has established the Baker Memorial professorship in the College of Agriculture in memory of the late Dean Charles Fuller Baker, who died in July, 1927. This professorship will provide for the services of a man from abroad who will be in residence at the college for at least eight months and will teach five hours a week.

Agricultural Education and Research in Irish Free State.—An agricultural department has recently been established in Dublin University, to which has been transferred Albert College at Glasnevin and the accompanying experiment station of the Irish Free State. The transfer includes a tract of about 350 acres of land, of which 40 per cent is under tillage, and a set of buildings providing living accommodations for about 50 students and recently remodeled by the addition of a new wing containing laboratories for plant pathology, agricultural bacteriology, botany, and zoology.

Agricultural Research in Albania.—According to a letter in *Rural New Yorker*, the department of agriculture in Albania is carrying on three experiment stations. Adaptation work with improved varieties of cereals, root crops, fruits, and livestock is a prominent feature of their work.

Much experimental work is also being done by the Albanian Vocational School at Tirana, the capital. This school was founded by the Junior American Red Cross in 1921 and is testing out various farm crops and fruits and attempting to improve the native cattle by crosses with Brown Swiss.

EXPERIMENT STATION RECORD

VOL. 61 OCTOBER ABSTRACT NUMBER No. 6

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

On the separation and determination of orthophosphoric and pyrophosphoric acids [trans. title], W. STOLLENWERK and A. BÄURLE (*Ztschr. Analyt. Chem., 77 (1929), No. 3–4, pp. 81–111, figs. 2*).—In a critical study of the reactions cited in the previous publications on the subject of the precipitation of pyrophosphoric acid for the purpose of quantitative determination, the authors of the present communication examined the possibilities of silver, copper, alkaline earth metal, magnesium, beryllium, aluminum, and lead salts, reaching the conclusion that for the purpose of quantitative determination only the alkaline earth metal salts are applicable where the determination both of pyrophosphoric and of orthophosphoric acids, occurring either separately or in mixtures of the two together, is concerned.

A method involving the use of the barium salts is described in considerable detail. This procedure provides for both the gravimetric and the titrimetric determination of either of the phosphoric acids named, either separately or when found together.

A considerable body of data illustrative (1) of the results obtained in the general critical study above mentioned and (2) of the degree of accuracy secured by the authors in the use of the proposed methods is presented in 14 tables, and evidence considered to demonstrate the existence of isomeric forms of the pyrophosphates is detailed and discussed.

On two new reversible oxydimetric indicators and the manganometric determination of hydroferrocyanic acid [trans. title], J. KNOP (*Ztschr. Analyt. Chem., 77 (1929), No. 3–4, pp. 111–125, fig. 1*).—The triphenylmethane dyes, erioglaucine A and eriogreen B, were both found to be reversible oxidation-reduction indicators sensitive to very small quantities of potassium permanganate, although not adapted for use in bichromate titrations. The application of these indicators was first made to the de Haen titrimetric determination of hydroferrocyanic acid with potassium permanganate, the end point having been sharp to 1 drop (0.02 cc.) of N/20 permanganate solution. The color of the ferrocyanide and ferricyanide ions did not interfere with the sharpness of the color change of the indicator, and the uncertainty with respect to the end point, considered formerly to have been characteristic of the de Haen method, was eliminated. With the assistance of the indicators it was found possible to demonstrate in the titration of hydroferrocyanic acid in the presence of hydrochloric acid an induced oxidation of the latter acid, although only to a small extent.

It is considered that the sensitiveness of the indicators named is sufficient so that, with suitable modifications of the technic, they could be used for microtitrations.

Other dyes of the triphenylmethane series considered capable of use as oxidation-reduction indicators are setopalin, setocyanine O, setoglaucine, xylene cyanol F, cyanol silk blue B, erio viridine, methyl violet B, acid violet 5 B, and acid green *GU*.

Various slightly different procedures were employed in the ferrocyanide permanganate titration, and illustrative results for each are given.

On the permanganate titration of iron with erioglaucine A (G) and eriogreen B (G) as indicators [trans. title], J. KNOP and O. KUBELKOVA (*Ztschr. Analyt. Chem.*, 77 (1929), No. 3-4, pp. 125-130).—The indicators noted as having been applied to the titration of ferrocyanide with permanganate in the work to which reference has been made above were in the experiments here described given a preliminary trial in the macro- and microtitrations of ferrous iron with permanganate. All of the figures given agreed closely among themselves and with the theoretical iron content of the salts used.

The indicators designated in the previous paper, erioglaucine A and eriogreen B, are here given the names erioglaucine A (G) and eriogreen B (G), however, though they appear to have been identical with the dyes used in the work above noted.

Reactions of carbon monoxide with compounds of metals with cysteine [trans. title], W. CREMER (*Biochem. Ztschr.*, 206 (1929), No. 1-3, pp. 228-239, figs. 9).—Ferrous sulfate and cysteine in an alkaline buffer solution (potassium borate, pH about 9.5) absorbed carbon monoxide, according to the results here reported, with the formation of a carbonyl derivative in which 1 gm. atom of the iron was found to have combined with 2 moles of carbon monoxide. With isocysteine iron and carbon monoxide behaved similarly. Cobalt also formed a compound with cysteine and carbon monoxide, but in this case but 1 mole of carbon monoxide was observed to combine with 1 gm. atom of the metal.

Carbonylferrocysteine and carbonylferroisocysteine were dissociated on exposure to light, the reaction proving reversible, whereas under the same conditions cobalt carbonylcysteine was not sensitive to light.

The *d*-rotatory power of carbonylferrocysteine was found to be about 60 times that of the *d*-cysteine from which it had been prepared. The rotatory power of carbonyl cobalt cysteine, however, was not measurable. The catalysis by iron of the oxidation of cysteine was hindered by carbon monoxide.

The adsorption of hydrogen ions and its effect on the swelling and electrical charge of gelatin, B. N. GHOSH (*Jour. Chem. Soc. [London]*, 1928, Mar., pp. 711-719).—From simultaneous measurements of the electrical charge and of the swelling at various pH values, the conclusion was drawn that apparently electrostatic repulsion between similarly charged particles of the gel can not account for the observed swelling, and that, further, the swelling is not due to the increasing hydration of the particles of the gel which accompanies the increase in the electrical charge. It was concluded, also, that the quantity of the hydrogen ion taken up by the gelatin could be calculated "with fair accuracy" from the Langmuir adsorption equation, an equation for swelling, based on this concept, being presented.

"A proportionality between the amount of hydrogen ions adsorbed and the electrical charge has been observed. For hydrochloric, nitric, and trichloroacetic acids the ratio of the electrical charge to the amount of hydrogen ions adsorbed is nearly constant. For sulfuric acid the ratio diminishes with increasing hydrogen-ion concentration."

On ultrafiltration as a method for the removal of protein for the determination of amino and residual nitrogen in the blood [trans. title], B. A. WILENSKI (*Biochem. Ztschr., 204 (1929), No. 4-6, pp. 433-438, fig. 1*).—A description is given of a small apparatus for ultrafiltration, (capacity about 20 cc. at each filling of the vessel designed to contain the liquid to be filtered).

Using this device for the removal of the proteins from blood plasma, the author found in preliminary trials that ammonium sulfate, urea, glycine, tryptophane, glycylalanine, uric acid, and creatinine passed quantitatively through the apparatus, whereas the proteins of the blood plasma were quantitatively retained. The points of advantage of ultrafiltration over precipitation procedures for the removal of proteins from plasma are noted, and some details of the analysis of the ultrafiltrate are discussed.

The detection of adulteration of butter and ghee with animal fat, P. SANYAL (*Jour. Cent. Bur. Anim. Husb. and Dairying, India, 2 (1928), No. 3, pp. 130-134*).—The author outlines two tests for the detection of adulteration of butter and ghee with animal fat. The first test gives a positive indication in the case of cow butter and ghee and for buffalo butter from animals not fed cottonseed while the second test is used in the case of butter from buffaloes fed cottonseed.

In the first test 1 gm. of melted fat is dissolved in 3 cc. of dry purified acetic ether and 4 cc. of 93 per cent alcohol and held at 30° C. for 30 minutes. If no precipitate appears in this time the butter may be considered free from foreign fats. In the second test 4 cc. of acetic ether and 3 cc. of 93 per cent alcohol are used, and if a precipitate appears within the 30 minutes the sample is adulterated. It is not possible with these tests to determine the extent of adulteration.

SOILS—FERTILIZERS

A handbook of soil science, I, edited by E. BLANCK (*Handbuch der Bodenlehre. Berlin: Julius Springer, 1929, vol. 1, pp. VIII+335, figs. 20*).—A general textbook of the scientific study of the soil is intended, the nature of the first volume, here noted, being indicated by the main subdivisions of its contents. These are as follows: An introduction comprising chapters on the study of the soil as a science and on the historical aspects of the development of soil science up to the beginning of the twentieth century; and part 1, the general or scientific study of the soil, under which are included the parent material and the natural science fundamentals of the study of the processes of soil formation, with numerous subdivisions of this last-named subject.

American soils as seen by Russian investigators, J. S. JOFFE and I. ANTIPOV-KARATAEV (*Soil Sci., 27 (1929), No. 2, pp. 159-166*).—"The review of the papers by the three Russian investigators shows a marked similarity—with the exception of minor differences on the intrazonal soils—of opinion, which is based on the system of zonal divisions of soils. This fact seems to indicate that the genetic approach as laid down by Dokuchaev is the proper method for the study of soils."

An improved soil-sampling tube, F. J. VEIHMEYER (*Soil Sci., 27 (1929), No. 2, pp. 147-152, figs. 4*).—A soil-sampling tube designed to provide by means of special drive points for the different types of difficulty encountered in the sampling of gravels, sands, and clays is described in this contribution from the California Experiment Station, together with hammers suitable for the driving of the tubes and a lifting device or jack for pulling the tubes. The last-named piece of apparatus is constructed from two automobile jacks, the lifting elements of which are joined at the top by a yoke from which

two links suspend a grip or chuck provided with fiber-lined jaws so designed that although the gripping force is increased with the pulling effort a crushing or denting effect upon the soil tube is rendered impossible. Machinist's drawings covering all parts of the outfit accompany the paper.

It is stated that the tube puller described "has never failed to work successfully, although its bulk and slowness of operation are disadvantages."

An efficient soil tube jack, C. A. TAYLOR and H. F. BLANEY (*Soil Sci., 27 (1929), No. 5, pp. 351–353, figs. 3*).—The design presented is that of an apparatus successfully used in operations of the U. S. D. A. Bureau of Public Roads for the withdrawal of soil tubes used in securing samples to a depth of 18 ft., the tubes being driven into the ground with 30-lb. hammers. The base of the fulcrum is constructed of aluminum and has an area of 120 sq. in., said to give an ample bearing surface on the ground. The weight of the complete jack with handle and grip has been reduced to less than 23 lbs. An estimated pulling force of over 4,000 lbs. has been secured with the device, and the cost is stated as $30. The operation of the machine is illustrated by a photographic plate.

The hydrogen peroxide-hydrochloric acid treatment of soils as a method of dispersion in mechanical analysis, G. B. BODMAN (*Soil Sci., 26 (1928), No. 6, pp. 459–470, fig. 1*).—The soils used in this comparative study by the California Experiment Station of the two types of treatment discussed were (1) a Montezuma clay adobe, the surface 14 in.; (2) a subsoil from 32 to 40 in. depth of the above-named soil; (3) a Fresno sandy loam, a "black alkali" soil, the surface 12 in.; (4) a subsoil of an Aiken clay loam from 12 to 14 in.; and (5) a San Joaquin sandy loam sample taken from a hardpan layer, 25 to 30 in. from the surface.

The ammonia treatment is described as having consisted essentially in a rubbing of the soil for 10 minutes with a rubber-tipped pestle in an agate mortar in a solution of 1 part of ammonia in 3,000 parts of water, the samples having been shaken in an ammonia solution of the same concentration for 15 hours following the preliminary rubbing. The subsequent treatment was the same as that applied in the acid-peroxide method "except that all withdrawn samples and separates were treated with 25 cc. of 3 per cent hydrogen peroxide in order to remove the organic matter before weighing." Tables and curves represent the results obtained in the comparisons, and the possible effects of the two treatments on the "apparent physical composition" of the soils are discussed.

"A much higher degree of dispersion, as measured by the yield of finer mineral fractions, was obtained for the rather highly organic soil used, and for its calcareous substratum, when treatment with hydrogen peroxide and hydrochloric acid preceded shaking. For the hardpan soil examined the peroxide-hydrochloric acid treatment was found to be entirely inadequate as a means of dispersion, and rubbing in dilute ammonia proved much more effective. A 'black alkali' surface soil and an apparently highly ferruginous clayey soil horizon were equally well dispersed by both methods.

"The advisability of subjecting calcium-saturated soils to the drastic treatment involved in the hydrogen peroxide-hydrochloric acid method is questioned."

Studies of certain phases of the interrelationship between soil and plant.—I, Availability of mineral plant nutrients in relation to the degree of dispersion, W. THOMAS (*Soil Sci., 27 (1929), No. 4, pp. 249–270*).—This first paper on the subject, a contribution from the Pennsylvania Experiment Station, is devoted entirely to a discussion of theoretical considerations and the collation of analyses of experimental results already published.

The first section contains an introductory discussion of (1) theories of per-

dialysis experiments. A second section deals with artificial membranes, and living isolated cells and abnormal plants. A third section covers the subjects of (1) the distinction between permeability and absorption and (2) the arguments advanced against the solution theory of plant nutrition. The latter subject comprises the greater part of the entire paper and is further subdivided into the following topics: The relation of the composition of the solution to the mineral elements taken up by plants, the absorption of silica by plants, the "solubility" of silica, the effect of silica gels on the absorption of other ions by plants, the absorption of iron by plants, the availability of mineral phosphates, superphosphates, sparingly soluble phosphates, solubility and availability of "floats," acids as a factor, absorption of the phosphate ion from very low concentrations, iron and aluminum phosphates, and basic slags.

The paper is accompanied by a bibliography of nearly 100 references.

The dispersion and mechanical analysis of heavy alkaline soils, A. F. Joseph and O. W. Snow (*Jour. Agr. Sci. [England], 19 (1929), No. 1, pp. 106–120, figs. 4*).—A method designated as the Sudan method, involving no pretreatment of the soil but requiring the use of sodium carbonate as deflocculant with or without subsequent centrifuge treatment, a pipette method in which the pretreatment consisted in washing the soil for several days on filter paper followed by sodium carbonate as deflocculant, a pipette method in which the pretreatment consisted in washing the soil 30 times with water and settling by means of the centrifuge, and, finally, a third modification of the pipette procedure in which a pretreatment with hydrogen peroxide and hydrochloric acid followed by three washings with water was employed, were all applied to the same soils with results and conclusions including those stated below.

The form of the dispersion curve "obtained by single dispersion treatment below 2μ" was found to vary greatly not only as between different soils but also as between different preparations of the same soil saturated with different bases. Between the proportion of very fine material, for example, that having a particular size below 0.5μ, and "other important soil properties," no connection could be observed. "The proportion of the very fine material determined in this way would not, therefore, afford any indication of the 'colloid' properties of the soil. If the proportion of fine material were estimated by a decantation method the results might be substantially modified."

It was found that under the same conditions of dispersion sodium soil was better dispersed than was the ammonium saturated preparation. The conclusion was drawn that "sodium carbonate should therefore be the best medium for mechanical analysis."

The proportion of clay found was in no case observed to be importantly affected by the use of hydrogen peroxide. With none of the soils examined was the number of decantations required made less by pretreatment with acid, those studied having given the same figures for the clay content, when puddling with sodium carbonate was adequate, whether acid had been used or not.

Certain of the soils examined were found not to be dispersed in a single operation, as is required for the pipette method, by any procedure applied for the purpose. In some of these cases the difficulty could be ascribed to the presence of gypsum, but in certain other cases no explanation of the difficulty could be made. For the Sudan soils decantation methods appeared essential, hydrogen peroxide was found not to be needed, pretreatment with acid was found unnecessary, and sodium carbonate, as in other cases studied, was a better dispersant than was ammonia. The opinion is expressed "that the same holds good for many other soils."

The properties of heavy alkaline soils containing different exchangeable bases, A. F. JOSEPH and H. B. OAKLEY (*Jour. Agr. Sci. [England], 19 (1929), No. 1, pp. 121–131, figs. 2*).—The nature of the replaceable base content of a soil or clay was found to have a very great influence upon the physical properties, the most marked claylike qualities having been conferred upon the material by lithium, sodium, and magnesium.

It was not found possible to correlate the proportion of fine material (defined as that remaining in suspension in a column 10 cm. in height after 14 days' standing) with other physical properties. For example, a soil, of which more than 50 per cent was dispersable as fine material defined as above, showed itself the least plastic of any of the soils examined.

In comparisons of sodium, potassium, and calcium clays, potassium was observed to resemble sodium in such chemical relationships as that of the base exchange, but had a very different effect upon such properties as plasticity and permeability. On treatment of the material with mixtures of 0.5 N solutions of the chlorides of two of the bases, calcium and potassium were found absorbed in equivalent quantities, but the quantity of sodium absorbed was only one-sixth of the absorbed quantity of the calcium or potassium.

Exchangeable cations in soils as determined by means of normal ammonium chloride and electrodialysis, B. D. WILSON (*Soil Sci., 26 (1928), No. 6, pp. 407–421, fig. 1*).—This is a contribution from the New York Cornell Experiment Station in which are reported the results of a comparative study by extraction with N ammonium chloride solution and by electrodialysis of certain of the exchangeable cations of 12 soils representative of the 6 types, Duchess silt loam, Ontario loam, Vergennes clay, Volusia silt loam, Dunkirk silty clay loam, and Wooster gravelly silt loam.

Soils of these types were found to vary widely as to the quantity of the several cations extracted, as were also some of the soils of the same type. The quantity of cations present in the soils appeared, in some measure, an index of their fertility. Titrating the diffusates of electrodialyzed soils for total cationic content by means of standard solutions was found to be a rapid and convenient method for their determination, proving more satisfactory than did the method based on the quantity of ammonium ion absorbed from NH_4Cl. The quantity of calcium replaced by the two methods was in close agreement, the electrodialytic method showing a tendency to give smaller values; but larger quantities of magnesium and, in some cases, larger quantities of potassium were extracted with N NH_4Cl than by electrodialysis under the influence of a direct current of suitable strength. The discrepancy between the methods was intensified when the exchangeable quantities of these latter cations were large.

When the soils were electrodialyzed with a direct current of 110 volts, with no resistance in the circuit the electrodialytic and N NH_4Cl methods extracted about equal quantities of the three cations. This relationship together with the results obtained from fractional electrodialysis were taken to indicate that calcium, which was the predominant replaceable cation in the soils investigated, is extracted more easily by electrodialysis than are magnesium and potassium. Soils which had been electrodialyzed with a current of comparatively small amperage and freed subsequently of soluble anions were leached with N NH_4Cl and the extractable cations determined. Relatively large quantities of magnesium, potassium, aluminum, and smaller quantities of iron, but comparatively little calcium, were removed in this manner. The quantities of aluminum obtained indicated a partial decomposition of the alumino-silicic complex. The soils of the investigation, when electrodialyzed and rendered free of soluble anions, approached a reaction value of pH 4.0.

"The results of the investigation suggest that the cations extracted from acid soils by means of N NH_4Cl may include certain cations which are not held in the absorbing complex of the soil, and hence not exchangeable cations as this term is usually employed. It is likely that the formation of HCl resulting from the absorption of NH_4 from NH_4Cl with the liberation of hydrogen may partially decompose the colloidal fraction of the soil and certain of the soil minerals. It is possible that those cations which are extracted from soil by electrodialysis when the current-flow is relatively small represent more nearly the cations which are available as nutrients for growing plants than do those extracted with N NH_4Cl."

On the influence of the carbon : nitrogen ratios of organic material on the mineralization of nitrogen, H. L. JENSEN (*Jour. Agr. Sci.* [*England*], *19* (*1929*), *No. 1, pp. 71–82, figs. 4*).—Organic materials having carbon : nitrogen ratios ranging approximately from 85 : 1 to 10 : 1 and consisting of wheat straw, sweetclover, blue lupine, young plants of alfalfa, green pea pods, and mycelium of a Polyporus species, considered possibly to be *P. giganteus*, were submitted to nitrification experiments in an acid soil and in an alkaline soil (initial pH values 4.74 and 7.42, respectively), the period of the test having been in each case 6 months. In the acid soil only the pea-pod meal, with a carbon : nitrogen ratio of 13.3 : 1, showed an increase over the control in inorganic nitrogen. In the alkaline soil, however, the limiting carbon : nitrogen ratio, above which no nitrification occurred in the 6-months' period of the experiment, was 26 : 1. Below this limit nitrification was observed to take place at rates increasing rapidly with decreasing carbon : nitrogen ratios. The residue of nitrogen not converted into nitrates amounted to from 1.5 to 2.2 per cent of the original material. It was higher in the case of the materials rich in nitrogen.

All of the materials mentioned were found to show a tendency to increase the content of "α-humus" (defined as a crude mixture of humic and hymatomelanic acids), "though not to the same extent or in the same manner." More α-humus was produced in the alkaline than in the acid soil, except where barnyard manure had been applied as the source of organic matter. Straw, sweetclover, lupine, and barnyard manure were found apparently to act both through their lignin content and through the synthetic action of the microorganisms, they having increased the contents of nitrogen and of methoxyl in humus. The mycelium of the Polyporus species contained a fraction possessing the properties of "humic acid," rich in nitrogen but found to contain no methoxyl and which persisted in the soil.

In general, the experiments are considered to have shown that the carbon : nitrogen ratio is a factor exerting an influence upon nitrification as profound as that of the reaction of the soil, and that thereby can be explained the less complete utilization of barnyard manure nitrogen as compared with the nitrogen of artificial fertilizers.

Contribution to the chemical composition of peat, III, IV, S. A. WAKSMAN and K. R. STEVENS (*Soil Sci., 27* (*1929*), *Nos. 4, pp. 271–281; 5, pp. 389–398*).—Two papers are presented.

III. *Chemical studies of two Florida peat profiles.*—Results of chemical analyses of two peat profiles examined by methods described in the first contribution to the present series (E. S. R., 59, p. 717) are reported and discussed. Results obtained by these methods have already been reported (E. S. R., 59, p. 811) for both highmoor and lowmoor peats, but "the following studies deal with two more profiles, one lowmoor and one sedimentary, which were taken from a distinctly different region and which result from different plant associations and are formed under conditions entirely different."

The lowmoor peat used in these investigations represents a typical profile of the Everglade peat area in Florida, taken about 4 miles south of Lake Okeechobee and about a quarter mile west of Okeelanta.

This peat was found to contain but small quantities of cellulose in the upper layers of the saw grass peat, none in the plastic and lower fibrous layers. The chemical composition of the saw grass layers is considered similar to that of other lowmoor peats. Specifically, "it is characterized by a low content of ether-, alcohol-, and water-soluble constituents, a medium hemicellulose and ash content, and a considerable protein and lignin content. The plastic or sedimentary layer, however, is characterized by a low hemicellulose content and an exceptionally high ash content. The content of lignin-like complexes and proteins, when calculated on an ash-free basis, are similar to the saw grass peat layers."

A rapid evolution of nitrogen in an available form and its accumulation as nitrate was noted in the decomposition both of the saw grass and of the sedimentary layers, and the "ratio between the carbon liberated as carbon dioxide and the nitrogen changed to nitrate is very narrow (1.3:1 to 3.3:1), much more so than in the decomposition of organic matter in ordinary soil." No marked difference in the rate of liberation of nitrogen in an available form was detected as between the saw grass and sedimentary layers. "Any difference in fertility of soils produced by drainage and cultivation of the saw grass and sedimentary types of peat and any favorable effect of copper upon plant growth should be looked for not in any difference in the activities of microorganisms or liberation of nitrogen from the organic complexes of the peat, but as due to some other factor."

With regard to the second variety of peat, it is stated that "an analysis of the chemical composition of a sedimentary peat profile taken from a lake in Florida, outside of the Everglade region, shows a similarity of this peat to sedimentary (Gyttja) layers of other peats, namely freedom from cellulose, a low content of ether-, alcohol-, and water-soluble constituents, a fairly high hemicellulose content, a high ash, protein, and lignin content."

IV. *Chemical studies of highmoor peat profiles from Maine.*—This is a study of the peats of (1) Denbo heath, about 18 miles from Cherryfield, Me., a highmoor peat; (2) Veazie heath, near Orono, Me.; and (3) Garcelon bog, near Lewiston, Me. A more general study of the peat profiles of New England has been reported by Dachnowski (E. S. R., 56, p. 212). The peat deposits described were found very acid in reaction (about pH 4) in the spagnum layers, this high acidity having been accompanied always by low ash and nitrogen contents, except that the ash content was in certain cases somewhat higher at the immediate surface of the bog. The cellulose, hemicellulose, fat, and wax contents were high and the lignin content was low.

Microbiological activities in the soil of an upland bog in eastern North Carolina, I. V. Shunk (*Soil Sci., 27 (1929), No. 4, pp. 283–303, figs. 3*).—Report is made of a study of the microbiological activities observable in an upland grass-sedge bog and of the modifications of these activities brought about by adding lime and nitrogenous salts. The effects of drainage and of flooding were also included in these tests conducted by the North Carolina State College. The work led to the following general conclusions:

"Nitrification does not occur in this soil under natural conditions. It may be made to occur by liming and drainage as determined by pot experiments, but only after an interval of 6 to 10 weeks. No leguminous plants are found growing on the bog, and yet the soil contains 0.24 per cent of total nitrogen. The source of this nitrogen may be to some extent atmospheric nitrogen fixed

by nonsymbiotic organisms. Azotobacter species are not present on account of the soil acidity and anaerobic conditions, the pH of the soil being about 5.2. *Bacillus amylobacter* has been found in several samples of the soil.

"The addition of enough lime to the soil to neutralize the acidity results in a great increase in the numbers of bacteria, but does not appreciably change the numbers of fungi. Liming the soil markedly increases the rate of carbon dioxide production by the soil microorganisms.

"When the soil is saturated with water, or contains too little water, the rate of carbon dioxide production is reduced in comparison with soil at optimum moisture concentration. The soil has a wide carbon-nitrogen ratio, 13.6 : 1, which tends to retard the decomposition of the soil organic matter. When the soil is neutralized with lime and allowed to become quite dry, actinomyces become very numerous. These give the soil a whitish appearance. Cellulose added to the soil in the form of filter paper is very slowly decomposed on account of the lack of available nitrogen."

Some influences of the development of higher plants upon the microörganisms in the soil, I, II, R. L. Starkey (*Soil Sci., 27 (1929), Nos. 4, pp. 319–334, fig. 1; 5, pp. 355–378, figs. 8*).—The first two papers of this series from the New Jersey Experiment Stations have essentially the content indicated below:

I. *Historical and introductory.*—The preliminary experimental observations indicate that microorganisms occur in greater abundance about plant roots than at a distance from the roots. Such appeared to be the case with all of the organisms studied, filamentous fungi, actinomyces, bacteria developing upon albumin agar, organisms developing upon nitrogen-free mannite agar, and the group of bacteria related to *Bacillus radiobacter* which develop as mucoid colonies upon nitrogen-free mannite agar. Different plants affected any one group of microorganisms differently and caused greater proportional and absolute increases in the abundance of one group of organisms than of another. Organisms related to the *B. radiobacter* group, bacteria developing upon albumin agar, and organisms developing upon nitrogen-free mannite agar increased to a greater degree as a result of plant growth than did the actinomyces or filamentous fungi. Soils supporting root development produced much more carbon dioxide than soils devoid of roots.

II. *Influence of the stage of plant growth upon abundance of organisms.*—This paper reports the results of experimental work on the influence of the development of higher plants upon the abundance, total and relative, of a variety of soil microorganisms, and presents the rather extensive data obtained in the growing of a considerable variety of plants both in the greenhouse and in the field. Periodic observations were made during the growth of the plants upon the abundance of bacteria, actinomyces, filamentous fungi, organisms developing upon nitrogen-free mannite agar, and other organisms growing on special culture media.

The development of higher plants was found to exert a pronounced influence upon the soil population, but the influence upon some organisms was greater than that upon others. The proportional increases in nitrogen-fixing organisms, actinomyces, and filamentous fungi was slight. The greatest proportional increases appeared in the *B. radiobacter* group of organisms, although very striking effects were apparent in the general bacterial population. The average of the seasonal effects of the various plants upon the bacteria ranged from 15 to several hundred per cent increase. Different plants exerted different degrees of influence upon the soil organisms. Some, for example potatoes, consistently increased the numbers slightly, while others, such as rape, increased the numbers in most cases to a striking degree.

The extent of the influence of any one plant upon the soil population varied with the stage of growth, slight effects having been apparent in the early stages of growth, while maximum effects appeared only after the plants had reached considerable size, after which the influences became less pronounced subsequent to the death of the plants. The length of the growing period is therefore considered an important factor in determining the extent of the effect of plants upon soil microorganisms. Because of the longer growing periods of biennials, the plants were found to show a much more prolonged effect upon the organisms than did annuals. Legumes were not found to exert any more pronounced effect upon the soil organisms than did nonlegumes. The extent of the effects of plants upon the soil organisms was indicated as determined not by the size of the different plants nor by the extent of their root development, but was considered possibly to be associated with some characteristics of the physiology of the plants, "particularly as regards quality and quantity of root excretions."

"The results emphasize the fact that higher plants are of great importance in bringing about an unequal distribution of microorganisms in the soil, and may be a major factor in determining the so-called seasonal fluctuation of microorganisms in soil where temperature and moisture do not appear to be related."

The effect of sweet clover and alfalfa roots and tops on the fungous flora of the soil, T. L. Martin (*Soil Sci., 27 (1929), No. 5, pp. 399–405, fig. 1*).—As a result of the treatment of a clay loam subsoil with the vegetable material specified, all of the substances added were found to influence the mold growth in the soil studied. Mucors were the more stimulated by the more succulent material, while with the progress of the decay the total numbers of organisms were found to have decreased, and the rapidity of their development, especially that of the Mucors, was lessened noticeably.

"The alfalfa root and sweetclover root incorporations do not influence the development as much as do the corresponding tops, but the roots increase the number of Penicillia more than do the tops."

The growth of Mucors was more rapid in the presence of sweetclover residues than in the soil to which the corresponding parts of alfalfa plants had been added, but with Monilia the opposite effect was observed. In general the alfalfa material appeared favorable to a wider variety of molds than the sweetclover material, the total number of colonies having been generally greater in the alfalfa-treated soil than in that containing sweetclover residues.

"After a period of 35 days, or after the subsidence of the vigorous growth of Mucors following the incorporation of the tops, the total number of colonies of molds is greater in soils treated with roots than it is in soils treated with tops of either alfalfa or sweetclover, and this is largely due to the greater number of Penicillia, although the roots also tend to have a greater variety of molds."

Effects of carbon disulfide treatment of soil for the Japanese beetle on the abundance of microorganisms and on the ammonia and nitrate content, W. E. Fleming (*Soil Sci., 27 (1929), No. 2, pp. 153–158*).—"In view of the great economic value of the ornamental and greenhouse crops that are treated annually," the author of this communication from the U. S. D. A. Bureau of Entomology studied the effect of carbon disulfide, both as vapor and as emulsion, upon the bacterial counts and the ammonia and nitrogen contents of samples of Sassafras loamy sand.

In the vapor experiments samples consisting of 2 kg. of the soil, suitably prepared, were placed in jars and treated with 1 cc. of carbon disulfide in each of 5 jars, an equal number of untreated jars having served as controls. All of the jars were sealed 48 hours. The vapor of the carbon disulfide was then allowed to escape under conditions of due precaution against contamination by bacteria

In the experiments with the emulsion of carbon disulfide 4 liters of an emulsion having a carbon disulfide content of 2 gm. were percolated through 4 kg. of the soil. The checks in this instance were percolated with 4 liters of water containing no carbon disulfide under conditions otherwise the same as those of the insecticide treatment. A further control series in this case consisted of jars of the soil treated neither with emulsion nor with the water. The concentrations of the carbon disulfide in these experiments were designed to be the same (1 lb. to 1 cu. yd.) as those applied in the practical employment of carbon disulfide as a soil fumigant.

"Treatment with 0.05 per cent carbon disulfide (1 lb. to 1 cu. yd.) did not affect the density of the bacterial population appreciably, but it stimulated the development of fungi. It also caused an accumulation of ammonia.

"Treatment under laboratory conditions with 0.05 per cent carbon disulfide emulsion was not satisfactory. The detrimental effect on the bacteria and fungi, the accumulation of ammonia, and the decrease in the concentration of nitrates in the soil are probably factors involved in causing the injury following treatment of ornamentals in poorly drained fields, or in fields puddled by the application of large volumes of water. It is probable that the results of treatment of well-drained, fertile soils with this concentration of carbon disulfide emulsion are very similar to those of fumigation when the same quantity of the gas is used.

"Treatment with 0.05 per cent carbon disulfide, either as gas or as emulsion, results in an accumulation of ammonia and in a change in the numbers of microorganisms. Care should be taken to aerate the soil after fumigation, and the emulsion treatment should be used only in well-drained soil, so as to avoid, as far as possible, excessive accumulations of ammonia."

The effect of moisture content and cropping on exchangeable calcium and magnesium, with particular reference to rice soil, W. H. Metzger (*Soil Sci., 27 (1929), No. 4, pp. 305–318, figs. 2*).—Report is made of the results of experiments carried out at the Arkansas Experiment Station on the effect upon the exchangeable calcium and magnesium contents of the soil brought about by cropping for a long period to rice, flooding the soil as in rice growing, and of cropping for one season to corn.

One of the soils used, a Crowley silt loam, cropped to rice for 15 out of the 20 preceding years, showed considerably more exchangeable calcium and magnesium in the surface soil than in the subsurface layers. Clarksville silt loam kept at 20 per cent moisture content for a period of 75 days increased in exchangeable magnesium as compared with the same soil held in an ordinary condition, the exchangeable calcium showing no appreciable change, however. Flooding with distilled water for a similar period depressed the exchangeable calcium, according to the observations here recorded, but increased the exchangeable magnesium content.

No measurable change was detected in comparing on a Clarksville silt loam the effect of cropping for one season to corn with that of fallowing.

Liming as a factor in the amelioration of deteriorated tropical soils, P. E. Turner (*Jour. Agr. Sci. [England], 19 (1929), No. 1, pp. 83–89*).—The investigation here reported was concerned with certain large areas of deterioated soils long under cultivation with a single short-term crop. These soils had previously been shown to "differ but little from those which still retain their fertility in their content of organic matter."

The soils constituting the special case under investigation, however, were found to have become markedly acid, and so deficient in exchangeable calcium as to indicate lime as the principal need. As a result of a series of controlled

more effective than was slaked lime; that single relatively large applications of lime gave more immediate good results than did small annual dressings; that apparently the liming was effective only to the depth to which the soil was worked, a result attributed to the impermeability of heavy deteriorated soils; and that significant increases in crop yields were obtained only on those plats of the soil in which it was found that neutrality had been attained and in which 80 per cent of saturation with calcium, a value described as comparable with that of the fertile soils of Trinidad, had been reached.

It is considered that "the experience of liming methods gained in Trinidad may be applicable to other areas of alluvial soils under cultivation in the Tropics."

Detection and significance of manganese dioxide in the soil, W. O. Robinson (*Soil Sci., 27 (1929), No. 5, pp. 335–350*).—Having noted in the determination of organic matter in a sample of Blakely loam that this soil decomposed the hydrogen peroxide added so rapidly that the organic matter was not destroyed, the author of this contribution from the U. S. D. A. Bureau of Chemistry and Soils was led to an investigation with the purpose of ascertaining "whether the hydrogen peroxide activity of a soil could be taken as a positive indication of the presence of manganese dioxide, and, if so, to study the distribution of manganese dioxide in some of the soil series." The Blakely loam above mentioned has been found to possess an unusual manganese content. Previous work on the occurrence of manganese dioxide in soils is briefly discussed, reference to a number of papers published as studies on this subject being included in the appended bibliography of somewhat more than 30 titles.

It was found that the presence of a small quantity of manganese dioxide in the soil causes the soil to decompose hydrogen peroxide so vigorously that the test serves to establish the presence in the soil of the compound in question. The test is not recommended for quantitative determinations of manganese dioxide in soils, however, "on account of probable differences to be found in the sizes of the manganese dioxide particles in different soils."

Manganese dioxide was found not to occur in clay or colloidal soil fractions. It was found in sands but occurred to a greater extent in silts, and the determination of the total manganese content of the silts and sands was found approximately to represent the manganese dioxide content of the whole soil.

With respect to the origin and occurrence of soil manganese dioxide it was found that "concretionary and other deposits of manganese dioxide in the soil are apparently formed through the agency of calcium carbonate," and that "the presence of manganese dioxide in the surface layers of soil is characteristic of certain soil series. These soils are characterized by a peculiar and unmistakable chocolate brown color."

AGRICULTURAL BOTANY

A textbook of general botany, R. M. Holman and W. W. Robbins (*New York: John Wiley & Sons; London: Chapman & Hall, 1927, 2. ed., pp. XIII+624, pl. 1, figs. 415*).—Although as compared with the first edition (E. S. R., 52, p. 397) the present volume shows numerous alterations, the organization and method remain essentially unchanged. Such revision as has been considered necessary is outlined in the preface.

Range resources of the San Luis Valley, H. C. Hanson (*Colorado Sta. Bul. 335 (1929), pp. 61, figs. 25*).—The results are given of an ecological study of portions of five counties which form a large intermountain plain in Colorado at an elevation of from 7,500 to 8,000 ft. Five vegetation types are recognized,

and their characteristic plants are enumerated. Data are given as to the prevailing species of plants in each vegetation type, the kind of pasturage afforded, etc., and suggestions are offered for range improvement.

A preliminary study of the unicorn plants (Martyniaceae), G. P. Van Eseltine (*New York State Sta. Tech. Bul. 149 (1929), pp. 41, figs. 15*).—The results are given of a study of the systematic botany of the family Martyniaceae, in which the author recognizes five genera as follows: Craniolaria, Holoregmia, Proboscidea, Ibicella, and Martynia. A number of new names, as well as several new species, are reported.

Comparative morphology of fungi, E. A. Gäumann, trans. and rev. by C. W. Dodge (*New York and London: McGraw-Hill Book Co., 1928, pp. XIV+701, figs. 449*).—This is a somewhat free translation, also a revision in respects indicated, of the author's work as previously noted (E. S. R., 58, p. 25), preserving, without necessarily supporting, the theoretical discussions of the author. The rearrangement of the orders for American use is made with the author's approval. The newer literature has been incorporated. A 40-page bibliography is supplied.

The structure and development of the fungi, H. C. I. Gwynne-Vaughan and B. Barnes (*Cambridge, Eng.: Univ. Press, 1927, pp. XVI+384, pl. 1, figs. 285*).—This is a brief textbook for students. The bibliography is selective, giving page-by-page references to the relevant papers. Primarily the fungus is dealt with, secondarily its effect on other organisms.

Drying capacity of living protoplasm in vegetative plant cells [trans. title], W. S. Iljin (*Jahrb. Wiss. Bot., 66 (1927), No. 5, pp. 947–964*).—From examples presented it is concluded that the protoplasm of plant cells may be subjected to complete desiccation, with possible exception in the case of plants containing in their sap abundant salts. Death of the cell is thought to be due to the fact that the removal of water from the vacuole brings about a mechanical deformation, causing it to rupture. When this rupture on drying out is prevented, the protoplasm is saved from death. The question is discussed as to how protection from this catastrophe is afforded in nature.

The penetration of CO_2 into living protoplasm, W. J. V. Osterhout and M. J. Dorcas (*Jour. Gen. Physiol., 9 (1925), No. 2, pp. 255–267, figs. 3*).—In view of the importance of the conclusion stated in a previous report (E. S. R., 59, p. 619) that under normal conditions little or no undissociated H_2S enters the cells of *Valonia macrophysa*, comparable experiments were carried out with CO_2 on account of its ready penetration and easy measurability. It was found that this gas also enters the normal cells of Valonia but little, if at all, except in the form of undissociated molecules.

"Whenever the interior of a cell is more acid than the surrounding medium (excess base being the same in both), we may expect that at equilibrium the internal concentration of total CO_2 will be less than the external."

Mechanism of the accumulation of dye in Nitella on the basis of the entrance of the dye as undissociated molecules, M. Irwin (*Jour. Gen. Physiol., 9 (1926), No. 4, pp. 561–573, fig. 1*).—The mechanism of the accumulation of brilliant cresyl blue in the sap of Nitella has been discussed (E. S. R., 59, p 619) on the basis of experiments with different concentrations of the dye at one pH value, and it is stated that experiments have been made with one concentration of this dye at different pH values. The present paper gives a fuller account of these experiments, with methods and with an analysis of the rate of penetration and of equilibrium. It is thought probable that cresyl blue enters living cells of Nitella only in the form of the undissociated molecule. "At equilibrium the total concentration of the dye in the sap is proportional to the concentration of the free base in the outside solution."

Lysis of concentrated bacteria-emulsions by the bacteriophage, A. GELJNS (*Centbl. Bakt. [etc.], 2. Abt., 71 (1927), No. 1-7, pp. 48-53, fig. 1*).—In experimentation testing what was considered as a very powerful bacteriophage by ascertaining its effects in very highly concentrated emulsions of *Bacillus danicus*, the author found that a complete lysis was effected in a mineral medium containing about 1,000 times the maximum of 500,000,000 bacteria per cubic centimeter, said to have been considered as the maximum by d'Herelle (E. S. R., 57, p. 181), who considered 250,000,000 per cubic centimeter as the best bacterial concentration for such a purpose. At the same time a marked increase was evident in the amount of amino acid and protein nitrogen. It is thought probable that in the lysis effected by the bacteriophage the proteolytic enzymes played a prominent part as regards the conversions of the protoplasm.

With *B. coli*, even a powerful bacteriophage could not clear an emulsion more concentrated than the maximum of 500,000,000 bacteria per cubic centimeter established by d'Herelle. The facts are discussed.

Wound hormones in plants [trans. title], B. WEHNELT (*Jahrb. Wiss. Bot., 66 (1927), No. 5, pp. 773-813, figs. 26*).—Having studied, principally in the young pericarp of Phaseolus, the wound hormones, the discovery of which is credited to G. Haberlandt,[1] and the functions of which, as reported by that author, have been noted (E. S. R., 49, p. 219), the present author details his own results as confirming and illuminating the conclusions of Haberlandt.

The rôle of mycorrhiza in plant growth, M. C. RAYNER (*Gard. Chron., 3. ser., 83 (1928), Nos. 2150, p. 174; 2151, pp. 193, 194; 2152, p. 214; 2153, p. 230*).—In the present series of articles the author essays to review briefly experimental evidence at present available regarding the nutritive relations in cases of mycorrhiza, to consider how far this evidence supports views of authors referred to as previously current, and to indicate the probable direction and extent of practical application of present knowledge on this subject. The two main structural types, ectotrophic and endotrophic, as here characterized, are retained as convenient, although they are admittedly not so sharply distinguishable as was formerly thought. "It is known now that mycorrhiza of the ectotrophic type often shows relatively heavy infection of individual root cells, and it seems likely that the structural differences may be related to the character of the fungi present and to soil conditions rather than to any fundamental distinction in the nature of the association as a whole."

Celery experiments, T. E. RAWLINS (*Phytopathology, 17 (1927), No. 10, p. 746*).—The addition of 2.5 per cent of soil from celery roots to fertile potting compost tripled the early growth of celery plants, giving also a very healthy appearance, whereas the plants lacking such addition of celery soil were stunted, chlorotic, and necrotic at the leaf margins. Further experiments are in progress to determine whether the increased growth is due to celery mycorrhiza.

The influence of alcohol upon the growth of seedlings, R. PEARL and A. ALLEN (*Jour. Gen. Physiol., 8 (1926), No. 3, pp. 215-231, figs. 2*).—The object of the experiments here reported was to determine the influence of ethyl alcohol, in small doses when applied to the dry seeds, upon subsequent growth of the seedling if kept without extraneous food and so had to depend solely upon the cotyledonary supply. All of the experiments were carried out with seed of *Cucumis melo*, the work giving a record of the growth of the cantaloupe seedlings as measured by increase in fresh weight following initial soaking of the dry seeds for three hours in ethyl alcohol of from 2 to 16 per cent strength by volume.

---

[1] Beitr. Allg. Bot., 2 (1921), No. 1, pp. 53, figs. 12.

It was found that when the seeds so treated were germinated and grown in distilled water in the dark, the total growth attained was greater by from 9 to 35 per cent than was that made by seeds treated similarly except that they were initially soaked in distilled water. It is claimed that this increased growth was due, not simply to differences in osmotic pressure in the different alcohol solutions, but probably to a simple selective action of the alcohol which eliminated the constitutionally weak and defective seeds.

Inorganic injuries to Pisum sativum and Phaseolus vulgaris, J. C. s'Jacob (*Anorganische Beschadigingen bij Pisum sativum L. en Phaseolus vulgaris L. Proefschr., Rijks-Univ., Utrecht, 1927, pp. IX+117+1, pls. 10, figs. 4*).—This is a Utrecht University thesis.

Temperature alternation and germination of vegetable seed, F. Kotowski (*Acta Soc. Bot. Polon., 5 (1927), No. 1, pp. 71–78*).—In continuation of studies previously noted (E. S. R., 58, p. 535), the influence on vegetables of 8 species exerted by 6 kinds of alternations was studied as regards the range of temperatures, and the results are herein detailed.

The alternation of temperatnres did not increase the percentage of seedlings. The daily use of low temperatures (4, 8, and 11° C.) during 16 hours in alternation with high temperatures (25°) during 8 hours gave better results than the reverse alternation. The coefficients of velocity of germination varied according to the change of lower temperatures. The rate of increase of the coefficients was dependent on the effect involved by temperature acting daily 16 hours.

The stimulation of seedling growth in connection with temperature alternation is given for most of the species studied.

The influence of light of different wave lengths on seed germination [trans. title], E. Kommerell (*Jahrb. Wiss. Bot., 66 (1927), No. 3, pp. 461–512, figs. 18*).—Quantitative experimentation on light wave length as a factor influencing germination in seeds of *Lythrum salicaria* and *Nicotiana tabacum* is detailed as to method, results (which are tabulated), and indications. The yield in plantlets produced is said to have been within limits directly proportional to wave length.

The effect on plants of radiations from a quartz mercury vapour lamp, E. M. Delf, K. Ritson, and A. Westbrook (*Brit. Jour. Expt. Biol., 5 (1927), No. 2, pp. 138–154, pls. 2, figs. 4*).—The general plan of this work was to determine the effect due to exposing plants growing under otherwise normal conditions to the full rays of a quartz mercury vapor lamp during short periods at different distances. Separate accounts are given of investigations as carried out independently by Ritson at Kew Gardens during August to November, 1926, and by Westbrook at Bedford College, Regent's Park, in August and September, 1926, the results from the two sets of tests being on the whole very similar.

A number of plants named grown in a greenhouse under full daylight were exposed daily to radiations from an Ulviarc lamp during intervals ranging in the different experiments from 30 seconds to 10 minutes. Exposures of 1 minute and upwards produced stunting and other effects as regards form and formation, though exposures of 30 seconds on Trifolium seedlings 6 weeks old showed no stunting but a favorable aftereffect. Exposures of 2 minutes given to Voandzeia receiving also natural illumination during only from 5 to 7 hours daily gave more serious effects than when this treatment was given to plants having a 12-hour exposure to sunshine.

Radiomorphosis in Antirrhinum [trans. title], E. Stein (*Biol. Zentbl., 47 (1927), No. 12, pp. 705–722, figs. 8*).—The term "radiomorphosis" is applied to a condition, or a change of condition, brought about by irradiation of seeds of

A. majus with γ-rays and in a smaller percentage by the use of β-rays, resulting in the production of at least four forms of what is styled radiomorphosis. The conditions and forms are discussed as to their nature and bearings.

Electrodialysis as a means of studying biochemical differences in abnormal apple tissue, J. C. Moore, R. G. Reeves, and R. M. Hixon (*Plant Physiol., 2 (1927), No. 3, pp. 313–324, figs. 6*).—The data here presented are considered to support the view of Pentzer (E. S. R., 57, p. 352) that apple Jonathan spot is due to a loss of acids during storage, also to show that electrodialysis provides a convenient means of studying chemical differences in the noncolloidal constituents of normal and of abnormal tissue. Quantitative differences which would be masked by large quantities of inert material are accentuated by this method of separating those portions which are soluble and chemically active. Qualitative analyses on the dialyzate indicate that potassium and sodium are removed from the tissue during the first hour, calcium, magnesium, iron, and aluminum after 130 minutes.

Stimulation effects in the plant world, I–III [trans. title], A. Niethammer (*Biol. Gen., 4 (1928), Nos. 3–5, pp. 259–290; 6–8, pp. 655–694; Protoplasma, 2 (1927), No. 3, pp. 392–400*).—Sections of the first two parts of this contribution deal with the influence of external stimulants on plants, regulational phenomena, the operation of natural stimuli, the question of plant hormones, problems of physiological stimulation, the significance and action of Röntgen rays, and elucidatory experiments. The third part deals somewhat more specifically with thyreoidea and zinc sulfate as regards their influence on resting buds and on cell division, presenting also the author's hypothesis in regard to the reawakening and promotion of further division and growth in cells after their attainment of full development, due, supposedly, to a corresponding alteration of the pH of the protoplasm.

On the mutual effects between the plant growth and the change of reaction of the nutrient solution with ammonium salts as the source of nitrogen, T. L. Loo (*Japan. Jour. Bot., 3 (1927), No. 3, pp. 163–203, figs. 5*).—In water cultures carried out with a number of cultivated plants in modified Knop solutions containing $NaNO_3$ and inorganic salts of ammonium as nitrogen sources, stress was laid on the observation of reaction change of the culture solution brought about by the growth of seedlings and on the effect upon growth. The reaction of the solutions containing NH_4NO_3, NH_4Cl, and $(NH_4)_2SO_4$, respectively, became acidic in degrees proportional to the degree of dissociation. Other changes are detailed, with discussion. Special characters of the plants as regards the production or the effects of reaction change are pointed out. The inferiority of ammonium salts as a nitrogen source for higher plants is ascribed to the increase of H ion of the culture solution containing it during growth. In solutions having NH_4Cl or $(NH_4)_2SO_4$ as the nitrogen source, acidity increase was somewhat retarded by adding phosphates of sodium to the solution, and this retardation promoted growth.

In solutions of strong buffer capacity the initial pH has great influence upon the growth of the plant. If the initial pH is not suitable, solutions of strong buffer action are rather injurious than beneficial. Superabundance of phosphate in the culture solution has some special ill effect on the seedlings of paddy rice. Phosphates of ammonium, potassium, and sodium produce a characteristic leaf tip whitening. The addition of calcium chloride generally gave good effect; the injury due to higher acidity may be lessened or avoided. In this work iron was added in the form of ferric chloride or ferrous sulfate. No difference in value as an iron source can be found between these salts when iron is added in very small quantity.

The effect of ethylene on the respiration of bananas during ripening, L. O. REGEIMBAL, G. A. VACHA, and R. B. HARVEY (*Plant Physiol., 2 (1927), No. 3, pp. 357–359, fig. 1*).—A method employing ethylene gas for blanching celery, as reported by Harvey, has been noted (E. S. R., 52, p. 640; 54, p. 137).

In studies on the physiological influence of unsaturated hydrocarbons in ripening green fruits and vegetables, the present authors have followed the rate of carbon dioxide production by ripening bananas. The method employed is claimed to permit the rapid rise and fall of the respiratory rate to be followed better than could be done by the method reported by Denny (E. S. R., 52, p. 626). It is thought that the high initial rate a few minutes after administration of the ethylene, followed by a rapid fall to below normal, may be due either to the increase of oxidation or to the increase in the permeability of membranes permitting the diffusion of the carbon dioxide already present in the cells. The rise after the second dose of ethylene is thought to indicate an increase in oxidation rate rather than change in permeability. Apparently, this stimulation wears off in less than one hour. The rather rapid removal of ethylene by oxidation, as in the animal body after anesthesia, is thought to supply an explanation. Continuous application of the ethylene appears necessary to continued increase in respiration.

Analyses are said to show that the treated bananas have one-fifth to one-fourth more sugar than the untreated bananas, and that the starch content is proportionately decreased, also that the activity of the diastatic enzymes, as well as the respiratory enzymes, is increased by ethylene.

GENETICS

Experiments in plant heredity, N. E. HANSEN (*South Dakota Sta. Bul. 237 (1929), pp. 24*).—A general review of plant breeding work at the station since 1895, consisting largely of reprints of papers such as that recently noted (E. S. R., 60, p. 528).

A study of correlated inheritance in a certain Avena cross, R. J. GARBER and K. S. QUISENBERRY (*West Virginia Sta. Bul. 217 (1928), pp. 47*).—Several filial generations of Gopher × Black Mesdag oats and the reciprocal cross were studied in two years to determine the inheritance of date of heading, leaf width, number of culms, and seed color. Black Mesdag is a midseason oats highly resistant to oat smut, with black seed and stiff culms and has broader leaves than Gopher and is inclined to develop fewer culms per plant. Gopher, a pure line selection from Sixty Day, is early maturing, white seeded, and has an exceptionally stiff straw.

Earliness was found to be inherited as a dominant character with certain evidence that at least two factor differences were concerned. Leaf width (at the widest part of the leaf) proved to be variable and influenced markedly by environment. The second leaf, from the top down, was found best for measurement. Leaf width appeared to be inherited, but the manner of its transmission was not determined. It appeared that multiple factors might be involved. Behavior in F_2 suggested that a high number of culms was inherited as a dominant character. Number of culms was variable and probably influenced considerably by environment. Black seed color was found to be dominant to white seed color, depending upon a single factor difference. Positive evidence of close linkage was not found between any two of the four characters studied.

Cytological investigations with Malus and Vitis [trans. title], B. NEBEL (*Gartenbauwissenschaft, 1 (1929), No. 6, pp. 549–592, figs. 55; Eng. abs., pp. 588, 589*).—A complete account of studies previously noted (E. S. R., 61, p. 24).

in which it was reported that the basic 2n number of chromosomes in the apple is 34 and in the grape 38. One tetraploid cultivated apple (Kola) was found, but no aneuploids were discovered.

Twin births and twins from a hereditary point of view, G. DAHLBERG (*Inaug. Diss., Faculty Med., Univ. Uppsala; Stockholm: Tidens Tryckeri, 1926, pp. 296+15+85, figs. 286*).—The author has summarized the relation of twinning to various other factors, finding an increase with advancing age of the mother and a greater tendency to twinning among country people than among townspeople. There was also found to be variation in the amount of twinning associated with different races. Where twins occur at the rate of $1/n$, triplets occur at the rate of $1/n^2$, quadruplets $1/n^3$, and quintuplets at the rate of $1/n^4$ of the population. The second part of the work deals with the differentiation between dizygotic and monozygotic twins, which could be accomplished roughly for a population on the basis of the number of dizygotic twins being equal to twice the number of pairs of unlike sexed twins.

Heredity in twins is discussed, as well as the similarity of abnormalities and the tendency to asymmetry.

FIELD CROPS

Crop rotations for West Virginia, D. R. DODD, R. J. GARBER, and T. E. ODLAND (*West Virginia Sta. Circ. 50 (1928), pp. 23, figs. 14*).—The relation of crop rotation to production, farm organization, and fertility, and the choice of a rotation for specific conditions are explained. Standard crop rotations varying in duration are indicated for different conditions in West Virginia.

[Forage production in Wales] (*Welsh Jour. Agr., 5 (1929), pp. 117–143*).—These pages include the following articles of interest to agrostologists: Some Studies in Pasture Establishment (pp. 117–126) and Nationality and Strain Test of Grasses (with Observations on Pasture Analysis Methods) (pp. 126–133), both by R. A. Roberts and W. A. Jones; Seeds Mixture Problems: Sowing and After-Management, by W. Davies (pp. 133–137); and Some Studies of Red Clover Varieties in Field Trials, by E. Jones (pp. 138–143).

[Field crops experiments in India, 1927–28], D. CLOUSTON (*India [Dept. Agr.] Rev. Agr. Oper., 1927–28, pp. 3–37, 42–47, pls. 4*).—Experiments and breeding work with field crops, conducted by the imperial and provincial departments of agriculture in the different divisions of India, resembled previous reports (E. S. R., 59, p. 524) in scope.

The contrast in response of kafir and milo to variations in spacing, R. E. KARPER (*Jour. Amer. Soc. Agron., 21 (1929), No. 3, pp. 344–354, figs. 3*).—Spacing experiments over 10 years at the Lubbock, Tex., Substation (E. S. R., 59, p. 730) showed that milo has averaged about 21 per cent more grain to the acre when planted from 18 to 36 in. apart in the row than when planted from 3 to 9 in. apart. Kafir yielded 13 per cent more grain when planted from 3 to 9 in. apart in the row than when spaced more than 18 in. apart. The difference in response to spacing appears due to marked variance in tillering habits, milo being profusely and kafir sparsely tillering. In both sorghums the number of tillers increases with the distance. The relationship between row space per plant and yield is shown to be curvilinear rather than linear in both crops. The correlation is in a positive direction in milo and normally in the negative direction for kafir. The variable response to various rates of planting evidently should be considered in experiments involving comparisons including different varieties of grain sorghums.

The significance of subsoil moisture in alfalfa production, T. A. KIESSELBACH, J. C. RUSSEL, and A. ANDERSON (*Jour. Amer. Soc. Agron., 21 (1929), No. 3,

pp. 241–268, figs. 3).—The relations of alfalfa to subsoil moisture were studied at the Nebraska Experiment Station on meadows of different ages and conditions of cropping, fields growing cereals for various periods since breaking up from alfalfa, and fields never cropped to alfalfa. The soil is mainly Carrington developed on Kansan drift, the surface a clay loam quite receptive to moisture, the subsoil of the second and third foot a tight clay, and the subsoil below this level a friable silt distinctly free of gravel and resembling loess to at least 35 ft. deep.

Alfalfa drew upon subsoil moisture to a depth of 33 ft. in a 6-year-old meadow and 25 ft. in a 2-year-old meadow. At the end of 6-, 3-, and 2-year periods of growth in three upland meadows the free water content had been reduced to about 2.5 per cent to depths of 25, 15, and 7 ft., respectively. Between the fifth and fifteenth foot in the 6-, 3-, and 2-year-old meadows the average moisture content has been reduced 11, 10.6, and 9.4 per cent, respectively, below that in adjoining cultivated fields. A 6-year-old alfalfa meadow produced most in the third year, with 7.2 tons of cured forage per acre, but yields thereafter were curtailed by subsoil moisture depletion, averaging 2 tons during the fifth and sixth years. Irrigation of part of this meadow in the sixth year brought the yield up to 6.72 tons for the season compared with 2.35 tons without irrigation, indicating that the shortage of production was due to moisture deficiency.

During 15 years of cropping to cereals after breaking up established upland alfalfa meadow, little moisture had accumulated beyond the seventh foot. The increase in moisture content from the 5- to the 35-ft. level appears to have averaged 0.4 per cent. At this rate nearly 225 years would be needed to restore the subsoil moisture removed by 6 years of alfalfa. Subsoil moisture was replenished more rapidly on low-lying land which received run-off from higher ground.

Alfalfa appeared to be greatly handicapped on land at some time previously in this crop. In one test a meadow sown 8 years after the previous alfalfa was broken up averaged in three years only 55 per cent as much as an adjacent meadow not previously in alfalfa. In a similar test started 4 years later the 2-year average yield was only 35 per cent as much. These results were found due to deficiency of available subsoil moisture at time of planting.

In a 3-year-old alfalfa field on land which had grown alfalfa once before, undersized taproots were found that branched profusely at a depth of about 5 ft. into a network of fine roots which were traced to a depth of 14 ft. In a field not previously growing alfalfa the plants had characteristically long, sturdy taproots, with many fine roots throughout the soil mass.

The effect of alfalfa on soil moisture, F. L. Duley (*Jour. Amer. Soc. Agron., 21 (1929), No. 2, pp. 224–231, figs. 3*).—Soil moisture determinations to a depth of 10 ft. were made at the Kansas Experiment Station during the seasons of 1926 to 1928 on upland in alfalfa since 1910 and also on land in a 16-year rotation including 4 years of alfalfa.

When the alfalfa was on the land the moisture content of the deep subsoil was reduced to a low point and remained almost constant. With most of the rainfall coming during the growing season, the moisture penetrated very slightly below a depth of 6 ft. and was used by the crop about as fast as it came. When the alfalfa land in the 16-year rotation was broken and kept in corn and wheat for 10 years, the deep subsoil did not gain materially in moisture. On a field in alfalfa for 18 years which was broken out early in June, 1928, and fallowed until August, both the soil and the deep subsoil gained rapidly in moisture, whereas other land carrying a crop made no concurrent gain. At least a short period of fallowing would seem valuable to conserve moisture for starting alfalfa.

A new smooth-awned barley for irrigated conditions in northeastern Colorado, D. W. ROBERTSON, A. KEZER, and G. W. DEMING (*Colorado Sta. Press Bul. 67 (1929), pp. 4, figs. 2*).—Comfort barley, developed at the Minnesota Station in cooperation with the U. S. Department of Agriculture, has yielded well under irrigation in Colorado and is recommended for trial where a high-yielding feed barley with smooth awns is desired.

Tests of native and foreign clover strains in West Virginia, T. E. ODLAND and R. J. GARBER (*Jour. Amer. Soc. Agron., 21 (1929), No. 3, pp. 355–360*).—In comparisons during the three years at the West Virginia Experiment Station uniformly good results were obtained with strains of red clover from Ohio, Wisconsin, Michigan, Idaho, and Tennessee, and these strains withstood the winters well and produced good crops from both the first and second cuttings. The clover strains of Italian origin were worthless for West Virginia conditions in general, and other European and Chilean strains tested suffered heavy winterkilling, produced poor yields, and were generally undependable and of little value.

Cotton: Partial list of publications in English, compiled by M. F. WARNER (*U. S. Dept. Agr., Agr. Libr. Notes, 4 (1929), No. 1–2, Sup., pp. 5*).—This list, a continuation of the list by Hawks (E. S. R., 55, p. 530), embraces about 90 titles.

On the effect of air-tight and carbon dioxide upon the storage of rice, M. KONDŌ and T. OKAMURA (*Ber. Ōhara Inst. Landw. Forsch., 4 (1929), No. 1, pp. 1–18, pls. 7*).—Dehulled kernels of Shinriki and Omachi rice were stored in zinc containers in carbon dioxide and also air-tight, and in straw bags for several years.

The rice stored in straw bags was damaged heavily by insects, the moisture content rose, the material lost by polishing increased, the flavor of the boiled rice was poorer, and after two years' storage the rice could not be used as food. When stored hermetically sealed the rice was protected perfectly from insects and vermin, less material was lost in polishing, and the good qualities of the rice were unaltered. While no significant difference was noted between the air-tight storage and the carbon dioxide storage, the latter seemed slightly superior in several respects.

Standardizing descriptive terms for rice, W. D. SMITH (*Rice Jour., 32 (1929), No. 5, pp. 30, 41*).—Fourteen rice terms are defined.

The percentage of nitrogen in different parts of soybean plants at different stages of growth, L. W. ERDMAN (*Jour. Amer. Soc. Agron., 21 (1929), No. 3, pp. 361–366, fig. 1*).—Inoculated plants of the Manchu and Dunfield (seed) varieties of soybeans and Peking and Midwest (hay) varieties field-grown at the Iowa Experiment Station on Carrington loam were collected at different stages of maturity, and the tops, roots, and nodules were analyzed for total nitrogen.

Seed varieties cut for hay contained a higher percentage of nitrogen in their nodules than the regular hay varieties. The seed varieties were richer in protein than hay varieties. As the percentage of nitrogen in the nodules decreased a corresponding increase took place in nitrogen in the tops, indicating that there was a transformation of nitrogen from the nodules to the seeds. In the early growth stages the percentage of nitrogen in soybean tops gradually decreased, but during September the percentage of nitrogen began to rise and usually reached a maximum at maturity. Soybean plant roots stripped of their nodules varied little in percentage of nitrogen during the various stages of growth.

Sudan grass for hay, seed, and pasture, R. E. KARPER, J. R. QUINBY, and D. L. JONES (*Texas Sta. Bul. 396 (1929), pp. 32, figs. 8*).—The characteristics, adaptation, and distribution of Sudan grass are described, and cultural practices are suggested for production of hay, seed, and pasture as a result of extensive tests at Chillicothe, Lubbock, and other localities in the State. In Texas Sudan grass is a good pasture and hay crop in all farming sections, and the south plains is the principal seed-producing area for the United States.

For hay the grass should be planted early enough to permit three cuttings in southern Texas and two in northern Texas. The optimum planting date ranges from March 1 in the southern section to May 1 in northern Texas. At Lubbock yields declined when planting was delayed beyond the latter part of April, and the best yields were made at Chillicothe by planting on or before May 1.

Sudan grass may be planted for hay in 18- or 36-in. rows or broadcast without influencing yields appreciably. Narrow rows made about 8 per cent more hay than wide rows at Lubbock, while at Chillicothe wide rows yielded about 13 per cent more than narrow rows. At both places yields favored row planting rather than broadcasting. Cultivated rows have been best for seed production. Seeding trials for hay showed from 15 to 20 lbs. to be enough seed for broadcast plantings and 5 lbs. for row plantings. For seed from 10 to 15 lbs. was best at Lubbock when broadcasted and from 5 to 10 lbs. when sown in rows.

While the hay cut at any of the premature to mature stages was palatable and nutritious, the most hay resulted from cutting when the grass was heading or in bloom. Sudan grass has made about 4 times as much forage as cowpeas at Lubbock and 2.5 times as much at Chillicothe, during which time it produced 67 and 62 per cent, respectively, as much forage as Sumac sorgo at these stations. It has compared favorably with the latter crop for forage production.

Sudan pasture is used in all farming sections of the State, but not extensively in the flat coastal plain of southeastern Texas where soil drainage conditions, insects, and red spot are unfavorable. For pasture the grass may be grown in rows or broadcasted at rates of from 10 to 15 and 10 to 30 lbs. It should not be grazed until the plants are from 15 to 18 in. high. Alternation of pasture is suggested to permit the grass to make new growth. In Texas small grain for winter pasture and Sudan grass for summer pasture offer a combination which provides grazing throughout practically the entire year. Continuous pasture can be supplied only if separate fields are provided for growing the summer and winter pastures.

Winter wheat tests in New Jersey, H. B. SPRAGUE and E. E. EVAUL (*New Jersey Stas. Bul. 483 (1929), pp. 30, figs. 9*).—Winter wheat, the grain crop second in importance in New Jersey, has averaged $1,641,000 in total value during the period 1924–1928 and $28.38 per acre as compared with $17.85 for the United States in the same period.

Considering yield, resistance to lodging, and grain quality, varietal trials during the period indicate Dawson, Red Rock, and Leap for New Jersey wheat growers. These varieties are illustrated and described briefly. Of less value are Fulhio, R–47, Red Wave, Forward, Nittany, and Fultz.

In a discussion of the relation between the weather conditions and the average performance of 14 sorts of winter wheat, it is pointed out that rather light rainfall, moderate temperatures, and sunny weather during April, May, and June appear to be most satisfactory for wheat production.

A partial analysis of yield of certain common and durum wheats, L. R. WALDRON (*Jour. Amer. Soc. Agron., 21 (1929), No. 3, pp. 295–309*).—Plant characters affecting yield were studied analytically on cultures grown in wheat nurseries at the North Dakota Experiment Station (Fargo) and at Langdon

The significance of correlations between yield as one variable and kernels per spikelet, number of fertile spikelets, sterile spikelets, mid and total kernels per head, weight of grain per 50 heads, stooling, numbers of plants and of heads, weight of grain per yard, and weight per 1,000 kernels are discussed in detail.

The results suggested that in the production of new varieties by breeding, careful attention must be given to the character of prolificacy, i. e., the number of kernels per head. While most common spring wheats are deficient in this respect, the evidence indicated that the Marquis × Kota hybrid selections described possess this character to a certain degree.

Cooperative rod-row wheat trials in North Dakota for 1928, L. R. Waldron (*Jour. Amer. Soc. Agron., 21 (1929), No. 3, pp. 287–294*).—In further cooperative rod-row wheat trials (E. S. R., 59, p. 631) conducted by the North Dakota Experiment Station in 1928, correlation data showed that yields in general reflect quite well the actual yielding capacities of the wheats at the various localities.

Ceres yielded significantly more than other common wheats in the State-wide comparison. In regional comparisons Mindum significantly outyielded Ceres, while the yields of Ceres and Reliance averaged the same. Ceres yielded significantly more than other wheats in other regional cases. Evidence of rust injury was shown by correlation data between Marquis and Ceres, but such injury was not indicated between Marquis and Hope.

HORTICULTURE

Gardening in the lower South, H. H. Hume (*New York: Macmillan Co., 1929, pp. XIX+453, pls. 49*).—A general discussion of plant materials and gardening principles and methods for the southeastern United States.

Starting early vegetable and flowering plants under glass, C. H. Nissley (*New York: Orange Judd Pub. Co.; London: Kegan Paul, Trench, Trubner & Co., 1929, pp. XVI+302, pl. 1, figs. 152*).—A comprehensive and well illustrated text on the growing of young plants, with particular reference to large commercial enterprises.

Climatic conditions of horticulture in Manchuria, A. D. Voeĭkov (Woeikoff) (*Klimaticheskie Usloviiâ Sadovodstva v Man'chzhurii. Harbin, Manchuria: Chinese East. Ry., Land Dept., Agron. Div., 1928, pp. 1+55+4, pls. 13; Eng. trans., pp. 23+4*).—A descriptive account of the climate, native and introduced horticultural plants, and of the general status of horticulture.

Relation between top and root size in herbaceous plants, J. W. Crist and G. J. Stout (*Plant Physiol., 4 (1929), No. 1, pp. 63–85*).—Studies at the Michigan Experiment Station with lettuce, radish, and tomato plants grown with careful control under different conditions in respect to soil modification, fertilizer treatment, and light showed the possibility of inducing great variability in the mass relation of top to root and of maintaining within certain limits desired balances between these two parts of the plant. With lettuce and radish the top-root ratio was lowered by long-day illumination. In the case of lettuce the top-root ratio was increased by added fertility, by the use of an acid muck and sand soil mixture as compared with a neutral fertile sandy loam, and by the addition of both lime and superphosphate to an acid muck and sand mixture. The top-root ratio for radish was higher in plants grown in a soil predominantly sandy loam than in a medium predominantly coarse sand. In the case of the tomato, pruning and defloration reduced the ratio between the top and the root, and bottom heat increased the ratio. Grouping plants of all treatments, the coefficient of correlation between top and root in lettuce (975

plants) was 0.521±0.018; in radish (277 plants) 0.728±0.019; and in the tomato (440 plants) 0.885±0.007.

Further studies on sex in asparagus, W. W. Robbins and H. A. Jones (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 13–16, figs. 2*).—Records taken at the California Experiment Station over several years on the comparative size, number, and yield of spears from staminate and pistillate asparagus plants bore out the previously reported (E. S. R., 58, p. 230) superiority of staminate plants. In average number of spears per plant and in average weight of spears the staminate plants were consistently in the lead, but the pistillate plants produced spears of the largest average weight. Grading the product of pistillate and staminate plants of the Palmetto variety, it was found for the 1928 season that 13.4 per cent of the staminate and 4.4 per cent of the pistillate product fell in the class below ⅝ in. in diameter, the margin of usefulness for canning. This difference was, however, more than offset by the greater yield of the staminate plants, 4,107.8 lbs. per acre above the ⅝ in. grade, as compared with 3,628.4 lbs. for the pistillate plants. The percentage of the several grades is traced through the cutting period. Considering early production, that is, up to April 1 when a change is made from green to white cutting, it was estimated that staminate plants had produced 652.4 lbs. and pistillate plants 385.5 lbs. per acre.

Does root selection accomplish its purpose in asparagus culture? V. A. Tiedjens (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 37–40*).—Investigations started by the Massachusetts Experiment Station in 1924 in which field run asparagus roots were divided according to size and then subdivided according to the number of bud clusters per crown failed to show outstanding results in favor of any one group. Small roots showed 13 per cent mortality as compared with 4 per cent in large roots, but there were many small roots that yielded as well as medium or large roots. For practical purposes the mechanical selection of large seed is said to increase the percentage of large producing roots but must be accompanied by careful culture of the roots. Individual plant selection is recommended for the investigator. The crowding of young plants in the seed bed may prevent normal development and hide the inherent quality of individuals. Faulty technic may easily decrease the benefit of improvement methods.

***A summary of the performance records of individual asparagus plants* in 1928,** L. G. Schermerhorn (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 35, 36*).—Records taken at the New Jersey Experiment Stations on some 1,500 asparagus plants showed great variability in growth and performance. As a rule, there were produced 2.75 spears during the spring cutting period of 10 weeks for each stalk present the preceding autumn. Plants differed markedly in the regularity and time of production, staminate and pistillate plants being scattered uniformly through the several groups. An examination of the crowns of plants with extra large stalks, from 18 to 22 mm., in autumn showed an approximate mode of 25 large, 11 small, and 8 dormant buds, while plants with a full stalk diameter of from 6 to 10 mm. had an approximate mode of 2 large, 56 small, and 46 dormant buds.

Cultural practices and green asparagus, V. A. Tiedjens (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 31–35*).—Studies conducted at the Massachusetts Experiment Station to determine the actual effects on production of various lengths of green on the spears at time of cutting showed no significant differences. Comparing 4 and 8 in. of green in a very thrifty 5-year bed, no difference was found in the number of spears per plant. In a 12-year bed no difference was observed in the number of spears, but there was a 23 per cent decrease in

the weight of spears in the 8-in. class. Records taken on plants in a single bed showed no significant differential effects of 4-, 6-, and 8-in. green lengths.

Various cultural practices, such as depth of planting, depth of tillage, length of cutting season, and the manner of cutting, are considered of greatly more importance than length of spear and are discussed in relation to their influence. For example, records taken on the product harvested in a single season from equal areas of a single bed by five different persons showed yields of 185, 205, 165, 90, and 74 lbs., respectively, with corresponding differences in quality.

Chemical composition of truck crops.—I, New Zealand spinach, Tetragonia expansa, H. P. Traub, C. J. B. Thor, and L. Zeleny (*Minn. Hort., 57 (1929), No. 6, pp. 172, 173*).—Analytical data presented for the succulent tips of the New Zealand spinach show 89.87 per cent of moisture and 10.13 per cent of dry matter, the latter consisting principally of protein 3.31 per cent and ash 2.06 per cent, with relatively low carbohydrates. The general composition was found very similar to that of the common garden spinach.

The influence of boron on the chemical composition and growth of the tomato plant, E. S. Johnston and W. H. Dore (*Plant Physiol., 4 (1929), No. 1, pp. 31–62, figs. 9*).—Boron in minute quantities, approximately 0.5 part per million of the nutrient solution, was found essential to the normal growth and development of the tomato plant in studies at the Universities of California and Maryland. In concentrations of 5.5 parts per million boron proved toxic. Boron deficiency was manifested in four distinct ways: (1) Death of the terminal growing point of the stem, (2) breakdown of the conducting tissues of the stem, (3) in a characteristic brittleness of the stem and petioles, and (4) in poor root development. Boron-deficient plants contained more total sugars and starch in their leaves and stems than did normal plants, a condition believed to be due to the breakdown of the conducting tissues, thus reducing their ability to translocate sugars. Benzene-soluble matter occurred more abundantly in the leaves of normal plants and in the stems of boron-deficient plants. The data suggest the existence of a quantitative relationship between the amount of growth and the amount of boron present in the nutrient solution.

Studies on tree root activities.—I, An apparatus for studying root respiration and factors which influence it, G. H. Harris (*Sci. Agr., 9 (1929), No. 9, pp. 553–565, figs. 20*).—A description is given of the mechanical features and the methods of operation of an apparatus devised at the University of California for studying the respiration of tree roots, as indicated by the quantity of carbon dioxide given off. Hoagland's nutrient solution was employed, supplemented by sufficient ferric tartrate or citrate to supply iron. Tests conducted with treeless containers showed only a negligible quantity of carbon dioxide given off, suggesting that this source was of no experimental significance.

Seedling fruit stocks, H. B. Tukey (*New York State Sta. Bul. 569 (1929), pp. 34, figs. 11*).—This is a progress report on miscellaneous fruit stock studies (*E. S. R., 61, p. 229*).

Much better stands were secured from domestic seeds of the pear and cherry than from those obtained abroad, with no significant differences in apple seeds. Ben Davis, Rome, Winesap, Wealthy, McIntosh, Whitney, and Northern Spy yielded vigorous, uniform seedlings equal or nearly equal to French crab standard seedlings. It was noted that each apple variety transmitted to its seedlings certain definite characteristics, some of which are recorded. Pear varieties also yielded seedlings of distinctive characteristics. Anjou, Bartlett, Burkett, Hardy, and Winter Nelis produced desirable seedlings. Good Myrobalan plum seedlings were obtained both from wild and cultivated trees. Carolina natural peach seeds gave better results than did those from the Muir

variety. Late-ripening varieties of cherry yielded more viable seed than did early varieties. Sour and Mazzard cherry seedlings were very subject to black spot. Sargent and Mahaleb cherries were resistant and *Prunus padus* seedlings almost immune. McIntosh pollinated with Baldwin, Rhode Island, and Delicious yielded 1.8, 0, and 66 per cent of seedlings, showing the important rôle of the pollen parent. Afterripening and stratification of fruit seeds are discussed, emphasizing the need of a period of afterripening under moist, cool conditions.

Methods of growing and handling seedlings are discussed in detail. No noticeable benefit was obtained from watering seedlings at the time of planting nor from irrigation during the growing season. No benefit was secured from the application of various high nitrogen fertilizers to Mahaleb seedlings. Spacing, on the other hand, had a significant influence in increasing the size of seedlings.

Of four methods of producing seedlings, (1) one year from seed, (2) two years from seed, (3) digging at the end of the first season and resetting, and (4) transplanting early in the first season of growth, the last gave the largest percentage of desirable seedlings of apple and pear. Mahaleb and Mazzard cherries and Myrobalan plum, on the other hand, all produced sufficiently satisfactory seedlings in one year without transplanting.

Defective graft unions in the apple and the pear, F. C. Bradford and B. G. Sitton (*Michigan Sta. Tech. Bul. 99 (1929), pp. 106, figs. 88*).—Based on the careful cytological study of various types of graft unions and the tissue of healed wounds, the authors discuss the physiological aspects of wound healing in the apple and pear and arrive at certain definite conclusions, the outstanding of which is that the swelling often found at the union is not associated with lack of congeniality between the stock and the scion. The uncongenial graft, pear on apple, produced no swelling, and conversely, the largest swelling was found in congenial grafts.

Cambial activity was the basic process underlying the establishment of successful unions. Uncongenial grafts, as represented by pear on apple or pear on quince, differed from congenial grafts prinicpally in the failure to maintain cambium continuity, the break coming apparently at the end of the growing season. With the continued growth of the stock and scion cambium failure leaves a zone of parenchymatous, sometimes suberized, tissue, and both the transpiration channels and the phloem become generally discontinuous.

In cases of congenial grafts final healing results from the establishment of cambium continuity. Considerable variation, apparently induced by differences in the nature of the wound surface, of environment, and of vigor of the tree, were noted in the processes of healing. Union by grafting followed processes observed in the healing of other wounds. The width of and the duration of the parenchymatous zone were observed to vary with the distances between the cambium edges of the stock and scion. It is pointed out that budding differs from grafting in that the primary union is between the surface of the cambium on the shield and the meristematic wood surface of the stock.

Paraffine wax—an aid to growth in transplanted trees and shrubs, J. A. Neilson (*North. Nut Growers Assoc. Proc., 19 (1928), pp. 44–51*).—The dipping of scions and of entire nursery trees in melted paraffin was found to have a favorable effect on subsequent growth, apparently by preventing excessive drying of the exposed tissues.

Straw mulching the home orchard, J. H. Painter (*[Oklahoma] Panhandle Sta., Panhandle Bul. 7 (1929), pp. 14, 15*).—Straw mulch 1 ft. thick materially increased the moisture content of the soil beneath fruit trees. In June the greatest increases were in the 5- and 6-ft. horizons and in December in the first and second.

The relation of spraying and dusting practice to spray residues, H. C. McLean (*N. J. State Hort. Soc. Proc., 1928, pp. 148–157*).—A general discussion of the spray residue problem in New Jersey.

Summer and early autumn apples offered the most difficult situation, since the fruit was harvested before rains could remove the residues and there was very little subsequent increase in size following spraying to reduce the proportion of residues to fruit. Dusting had a tendency to leave uneven amounts of residue. Varietal habit of growth was also a factor, since heavy foliage protected the treated fruit from rainfall.

Mechanical cleaners proved unsatisfactory, chiefly because they were unable to reach the calyx and stem cavities where much (55 per cent) of the total residue was located. Numerous laboratory tests showed hydrochloric acid in concentrations of from 0.3 to 1.25 to be the most efficient solvent of residues. Because of wax accretions apples should be washed as soon as possible after harvest. No evidence was obtained that acids affected keeping quality. Various washers are considered in respect to cost and effectiveness.

Value of Bordeaux mixture in blight control, F. C. Reimer (*Oreg. State Hort. Soc. Proc., 40 (1925), pp. 136–142*).—Investigations conducted at the Southern Oregon Substation, Talent, in 1923, 1924, and 1925 showed quite conclusively that Bordeaux mixture applied just before the pear blossoms opened markedly reduces the number of blossom infections from blight (*Bacillus amylovorus*). That an early spray is highly important was shown in 1924 when this one was inadvertently omitted and the infection was almost as severe on sprayed as on check trees. The author believes that the principal benefit of the Bordeaux lies in its repellent action on insects that normally carry blight from the hold-over cankers to the flowers and young twigs. The value of Bordeaux as a blight reducer is greatest in a dry climate such as prevails at Talent, and under humid conditions russeting injury often follows its use. The author emphasizes the fact that Bordeaux spraying should be regarded as purely supplementary to the regular program of cutting out cankers and blighted branches.

Fruitfulness in various fruits [trans. title], L. M. Ro (Roh) (*Trudy Mleev. Sadovo-Ogorod. Opytn. Sta. (Arb. Mleew. Gartenbau-Vers. Sta.), No. 15 (1929), pp. 97, pls. 2; Ger. abs., p. 86*).—The majority of apples studied were found self-sterile. In certain varieties, such as Boiken and London Pippin, which possessed a definite inclination toward self-sterility, there were observed marked variations between trees. Crossing resulted in higher fruit sets, and the fruits were more symmetrical. Self-fruitful varieties were exceptionally productive. The sweet cherries tested were all self-sterile, but in sour cherries there were a number possessing a high degree of self-fertility, notably Ljubskaja, Schöne von Chantenay, Eugenie, Palluau, and Folger. Among self-fertile plums were Victoria, Czar, Wangenheim, Nancy Mirabelle, Red Mirabelle, and Ontario.

The study of the order of flowering and pollination of fruit blossoms applied to commercial fruit growing, C. H. Hooper (*Jour. Roy. Soc. Arts, 77 (1929), No. 3981, pp. 424–438, figs. 5*).—A general discussion of the pollination problem in fruits and nuts, with data on the time of flowering and self- and cross-fertility in various pear, apple, plum, and cherry varieties. The valuable function of bees in aiding pollination is stressed, and a list of insects observed to visit fruit blossoms is presented.

Pollen viability and fertility in various fruits [trans. title], L. M. Ro (Roh) (*Trudy Mleev. Sadovo-Ogorod. Opytn. Sta. (Arb. Mleew. Gartenbau-Vers. Sta.), No. 14 (1929), pp. 3–76, figs. 3; Ger. abs., pp. 72, 73*).—Studies at the Mleev Horticultural Experiment Station showed great variation in the viability of the pollen of various fruits and in any one variety during a period of years.

Among the varieties listed as of low pollen germination are the Baldwin, Antonovka, and Ribston apples; Guyot and Pastor pears; Katherine, Prolific Damson, and Small Mirabelle plums; and Eugenie, Royale, Nouvelle Royale, Early May, Ohio Beauty, and Coe cherries. Apples and pears which showed poor germination for several years gave low sets in pollination tests. Two pairs of cherry varieties were discovered which were intersterile.

The viability of cherry pollen [trans. title], S. I. KOZ'MANOV (KOSMANOFF) (*Trudy Mleev. Sadovo-Ogorod. Opytn. Sta.* (*Arb. Mleew. Gartenbau-Vers. Sta.*), *No. 14* (*1929*), *pp. 77–81, pl. 1; Ger. abs., p. 81*).—When kept dry with calcium chloride, sweet and sour cherry pollen was held for 107 days. During this period afterripening apparently proceeded with a noticeable rise in viability. Afterripening was completed soonest in the early-blooming and early-ripening varieties.

A method of handling pollen of the apple and of the plum for long distance shipment, C. F. PATTERSON (*Sci. Agr., 9* (*1929*), *No. 8, pp. 491–493*).—Pollen of the apple, plum, and cherry was shipped successfully from the Summerland, B. C., Experimental Station to the University of Saskatchewan by simply inclosing the anthers and liberated pollen in metal boxes kept dry by a vial of calcium chloride. In the case of the apple pollen handled in this manner viability was retained for a long time, tests showing fair viability as late as the first week of July.

Pollination experiments with the White Calville apple [trans. title], F. BACH (*Gartenbauwissenschaft, 1* (*1929*), *No. 6, pp. 615–618, fig. 1*).—White Calville apple blossoms pollinated with Kalterer Böhmer, Gravenstein, and self yielded 23.5, 16, and 1.5 per cent of fruits, respectively, emphasizing the need of cross-pollination and also the value of a pollinizer of strong viability. Kalterer Böhmer and Gravenstein pollen tested in 10 per cent sugar solution attained maximum germinations of 90 and 30 per cent, respectively. In crosses between the Wintergold Pearmain female and White Calville male the ribbed character of the male parent was clearly evident in the mature fruits, an undoubted case of xenia. This phenomenon was also noted in a Wintergold Pearmain by Yellow Bellflower cross.

New fruits, E. F. PALMER (*Ontario Dept. Agr. Bul. 343* (*1929*), *pp. 23, figs. 19*).—A brief discussion of the plant breeding activities of the Horticultural Experiment Station, Vineland, Ont., supplemented with descriptions of the station originations and introductions and notes on methods of dissemination.

Fruit varieties in Ohio.—IV, Crab apples, C. W. ELLENWOOD (*Ohio Sta. Bul. 434* (*1929*), *pp. 13, fig. 1*).—In this, the fourth of a series (E. S. R., 60, p. 144), there are given brief comments on culture, origin of crab apples, dates of blooming, and desirable varieties, with descriptive notes for 18 of the more important varieties.

Pear growing with selected buds, S. MERRILL, JR. (*Jour. Heredity, 20* (*1929*), *No. 5, pp. 213–217, figs. 3*).—Considerable variation, such as russeting of the epidermis and malformation, was discovered in an intensive survey in a large number of Bartlett pear orchards in California. Sometimes the offtypes were confined to individual branches, and sometimes the entire tree was involved.

Maturity of apples in relation to long storage, M. DAVEY (*New Zeal. Jour. Agr., 38* (*1929*), *No. 3, pp. 172–176, figs. 5*).—Studies conducted by the New Zealand Department of Agriculture with Cox Orange, Worcester Pearmain, and Jonathan apples indicated that the application of iodine solution to the cut surface is not a reliable index to maturity. For example in the case of six Jonathan apples harvested at the same time from the same tree and outwardly similar, one fruit showed an advanced stage of maturity, two a uniform starch to sugar conversion, and three fruits practically no starch conversion.

Biology and refrigeration, F. Kidd (*Jour. Roy. Soc. Arts, 77 (1929), No. 3976, pp. 288–306, figs. 10*).—A general discussion upon the physiological aspects of fruit storage, including respiration, heating in transit, temperature relations, internal breakdown, etc.

The practical significance of increasing the daily light period of winter for strawberry breeding, G. M. Darrow and G. F. Waldo (*Science, 69 (1929), No. 1793, pp. 496, 497*).—Observations on strawberries brought into the U. S. Department of Agriculture greenhouses at Washington, D. C., in late autumn showed strikingly different variety responses. Missionary and Klondike resumed growth at once, although the latter made the stronger leaf growth. Howard 17, on the other hand, made practically no growth. Under artificial light, which prolonged the normal day to 10 p. m. (October 20 to January 19), Missionary responded more quickly than did Klondike, with Howard 17 showing almost no response.

Apparently certain varieties had no rest period. In some cases varieties which failed to respond to light increments in late fall or early winter did respond when brought in on February 1, but varieties of Alaskan and English origin were slow to respond even at this late date. The authors suggest that light response in the greenhouse may be useful in determining the regional adaptation of seedlings and new introductions.

An important character in strawberry variety classification, W. H. Upshall (*Sci. Agr., 8 (1928), No. 12, pp. 793, 794, fig. 1*).—Two well-marked types of pubescence, namely, adpressed and outspreading, were observed on the pedicels of strawberry plants, making possible the positive classification of all varieties into two distinct groups. Varieties of *Fragaria chiloensis*, *F. virginiana*, and *F. vesca* generally carried adpressed pubescence, and those of *F. moschata* the outspreading type.

Quality in grapes, F. T. Bioletti (*Sci. Mo., 28 (1929), No. 5, pp. 393–400, fig. 1*).—Emphasizing the fact that high quality in grapes is not necessarily associated with high selling values because of inferior shipping quality, public preference, etc., the author discusses the various factors—appearance, colors, size, form, flavor, taste, aroma, and texture—which go to make up quality, and also considers the means such as pruning, training, and ringing which develop the best possible quality in grapes.

Elements of grape growing in California, F. T. Bioletti (*Calif. Agr. Col. Ext. Circ. 30 (1929), pp. 37, figs. 5*).—General information is offered on culture and varieties.

Viticultural research, D. Akenhead (*[Gr. Brit.] Empire Marketing Bd. [Pub. 11] (1928), pp. 79*).—A general discussion upon the present status of scientific viticulture in Europe, based on a study of the literature supplemented by field observations.

Cacao research, W. G. Freeman (*Trop. Agr. [Trinidad], 6 (1929), No. 5, pp. 127–133, pls. 2, figs. 5*).—A summary of the results of 20 years' investigations with cacao have shown that cacao trees may be classified according to their bearing capacities, and that heavy bearing trees may or may not transmit their yielding capacity to their budded progeny. No method was found of establishing this fact except by actual test. Certain prepotent parental forms were isolated for practical use. Indications were obtained that wider spacing than now practiced would give larger yields in the long run, using coffee as fillers during the early life of the plantation. A reduction in the intensity of shade was found to increase yields and reduce the amount of black pod disease. Contrary to practical views, it was found that cultivation was not injurious but helpful by improving drainage and aeration and incidentally the health of the trees.

Chemical relationship between scion and stock in citrus, A. R. C. HAAS and F. F. HALMA (*Plant Physiol., 4 (1929), No. 1, pp. 113–121, fig. 1*).—Studies at the Citrus Experiment Station, Riverside, Calif., on the composition of the bark of the stock and scion of citrus trees, as compared with that of trees on their own roots, showed considerable variability in respect to soluble magnesium. The calcium content was found approximately of the same percentage in the ash of all samples, whether used as stock or scion, and no great differences were found in the dry matter content of the bark. Soluble magnesium, on the other hand, either as a percentage of the dry matter or of the soluble ash was lowest in the lemon and sour orange and highest in the sweet orange and grapefruit. In trees in which the scion was lemon and the stock orange or grapefruit, soluble magnesium was lower in the stock than in unbudded trees of the same variety as the stock. With sweet orange or grapefruit as scion and sour orange as rootstock, soluble magnesium content was higher in the rootstock than where lemon was used as scion.

Grapefruit culture in the British West Indies and British Honduras, H. C. POWELL (*[Gt. Brit.] Empire Marketing Bd. [Pub.] 13 (1928), pp. 53, figs. 11*).—A report on a personal survey of present activities and potential possibilities in grapefruit production in the British Colonies, supplemented with notes on methods employed in California and Florida.

Upon the ripening process in the lemon [trans. title], G. AJON (*Ann. R. Staz. Sper. Agrumic. e Fruttic. Acireale, 9 (1928), pp. 23–47*).—The results of chemical analyses of lemon fruits at various stages of development are reported and discussed.

The date palm, H. V. W. DOWSON (*Trop. Agr. [Trinidad], 6 (1929), No. 6, pp. 172, 173*).—Notes are given on (1) the date palm's origin and (2) date culture on the Shatt al Arab. The Hallawi is described as the most valuable commercial variety.

Observations on oil palms, T. D. MARSH (*Malayan Agr. Jour., 17 (1929), No. 1, pp. 16–26*).—Material yield differences were again observed in favor of hand-pollinated oil palms (E. S. R., 57, p. 341). A total of 389 bunches yielding 5,798 lbs. of fruits was obtained from 43 pollinated palms, as compared with 381 bunches netting 1,614 lbs. from the same number of control plants. The author points out that the gains from pollination, although large, were somewhat less than in the preceding year. Measurements showed but little difference in the comparative size of the pollinated and control palms, indicating that the greater production had not noticeably affected growth.

Cover crops for the oil palm plantation [trans. title], BLONDELEAU and ROCHETTE (*Bul. Matières Grasses Inst. Colon. Marseille, No. 3–4 (1929), pp. 96–112*).—The results of trials with various plants such as *Tephrosia candida*, *Indigofera sumatrana*, *Crotalaria retusa*, and *Vigna catjang* are presented.

Annual report of the Canal Zone Plant Introduction Gardens for 1928, J. E. HIGGINS (*Canal Zone Plant Introduct. Gard. Ann. Rpt. 1928, pp. 44, figs. 9*).—In connection with general comments on the results of acclimatization tests with the avocado, banana, coffee, mango, mangosteen, papaya, pineapple, and other tropical and subtropical species, the author reports the results of experiments with the mango. Root pruning or ringing combined with smudging was followed by a heavy flowering and fruiting. Smudging alone, on the evidence of a single tree, was ineffective. Whether root pruning or ringing without smudging would have been effective was not determined.

Daffodil growing for pleasure and profit, A. F. CALVERT (*London: Dulau & Co., 1929, pp. XIX+389, pls. 237, fig. 1*).—A monograph on the narcissus, with special reference to varieties and species and breeding.

Field book of common ferns, H. Durand (*New York and London: G. P. Putnam's Sons, 1928, pp. 219, pl. 1, figs. 118*).—A guide to the identification of 50 conspicuous species of eastern America, with suggestions on their culture.

Garden lilies, I. Preston (*New York: Orange Judd Pub. Co.; London: Kegan Paul, Trench, Trubner & Co., 1929, pp. 126, pls. 11*).—An authoritative and practical discussion of lilies—their culture, propagation, and breeding.

American plants for American gardens, E. A. Roberts and E. Rehmann (*New York: Macmillan Co., 1929, pp. [8]+131, pls. 11*).—Attention is directed to the large number of native plants worthy of consideration by American gardeners, with comments on their outstanding qualities, and their soil, moisture, light, and temperature requirements.

The summer care and maintenance of home grounds, J. H. Painter (*[Oklahoma] Panhandle Sta., Panhandle Bul. 7 (1929), pp. 3–8*).—This is a general discussion.

Dr. Walter Van Fleet, F. L. Mulford (*Natl. Hort. Mag., 8 (1929), No. 2, pp. 52–60*).—A brief account of the life history and activities of this eminent plant breeder, including a list of his crosses and a bibliography of his writings.

FORESTRY

The need for standardized quantitative methods in forest biology, S. A. Graham (*Ecology, 10 (1929), No. 2, pp. 245–250*).—A general discussion stressing the fact that biotic information to be of maximum value should be expressed in accurate comparable terms.

The diurnal and annual fluctuations of temperature in the interior of a large tree, A. O. Barrett (*Roy. Soc. Victoria Proc., n. ser., 41 (1928), No. 1, pp. 32–44, fig. 1*).—Records taken on a *Pinus canariensis* tree 12.5 ft. in circumference at a height of 3 ft. showed (1) the mean annual temperature of the heart wood was 1° F. lower than that of the air, (2) the temperature of the alburnum was 1.1° higher than the air, and (3) that of the duramen and alburnum combined was equal to the air. No effect was noted of pollination or of the flush of spring growth on temperature. Drenching rains, although colder than the bark, raised the temperature 0.5°.

Theoretical calculation of the pressure distribution on the basal section of a tree, J. F. Martley (*Forestry, 2 (1928), No. 1, pp. 69–72*).—No evidence was found in studies with Douglas fir to suggest that the pressure gradient set up in a tree due to its continuously increasing weight has any measurable effect on longitudinal dimensions following the release of these strains in cutting. The pressure gradient was not sufficiently great to be a contributory cause to the production of brashness in wood.

Research in wood structure, J. F. Martley (*Forestry, 2 (1928), No. 1, pp. 62–68*).—Stating that the collection of identified wood specimens housed at the Imperial Forestry Institute now contains some 3,000 samples, the author adds that the structural characteristics found most useful in identification include the presence or absence and the size and distribution of the vessels, wood parenchyma, and resin ducts; the size and structure of the medullary rays; and the size, shape, and number of pits and other sculpturing of the cell walls. The value of a knowledge of the anatomical structure of timbers is stressed, both as relates to forest production studies and to practical utilization.

How fast do northern hardwoods grow? R. Zon and H. F. Scholz (*Wisconsin Sta. Research Bul. 88 (1929), pp. [2]+34, figs. 11*).—Studies conducted cooperatively by the Lake States Forest Experiment Station of the U. S. D. A. Forest Service and the station in virgin, clean-cut, and partially-cut stands in northeastern Wisconsin indicated that the greatest increment in board feet

occurs in the partially-cut stands. In virgin forests the loss through windfall and mortality, estimated in some cases as high as 227 bd. ft. per acre per year, practically offset increment. In the clean-cut areas the estimated growth is at the rate of from 55 to 65 bd. ft. per acre per year, but this growth does not become available until the stand reaches an age of from 80 to 100 years. Partial cutting accelerated the growth of the remaining trees, and the growth ranges from 110 to 195 bd. ft., depending on the number and size of the remaining trees.

The definite relationship observed between the amount of merchantable timber, the number and size of the remaining unmerchantable trees, and the percentage at which the merchantable stand is increasing in growth was found useful in predicting future growth.

Certain definite changes were noted in the composition of the stand as the result of cutting methods. Clean cutting favored the development of yellow birch, basswood, and elm, with less sugar maple and hemlock than was in the original forest. Partial cutting encouraged sugar maple at the expense of yellow birch, basswood, and elm. An almost pure maple forest is possible as the result of continued partial cutting.

Some ecological factors in secondary succession: Upland hardwood.—I, Evaporation studies in the Sycamore Creek region, S. A. CAIN and R. C. FRIESNER (*Butler Univ. Bot. Studies, Paper 1* [*1929*], *pp. 15, figs. 3*).—Atmometer readings taken in central Indiana in (1) beech-maple climax, (2) sassafras-aspen-sumac thicket, (3) blackberry-cinquefoil old field association, (4) mesophytic ravine, and (5) oak ridge association showed that the evaporating power of the air varied markedly in the different sites. Evaporation was greatest in the old field association and decreased in order through sites 2, 5, 4, and 1. Averaging all of the stations together, the greatest rate of evaporation was in the spring (the last two weeks of May).

General and successional ecology of the lower tropical rain-forest at Barro Colorado Island, Panama, L. A. KENOYER (*Ecology, 10* (*1929*), *No. 2, pp. 201–222, figs. 8*).—An account of studies in a region where the annual rainfall is about 110 in. per year, the temperature high and uniform, and the relative humidity from 77 to 88 per cent throughout the entire season.

Oregon's commercial forests, G. W. PEAVY (*Oreg. State Bd. Forestry Bul. 2, rev.* (*1929*), *pp. 94, figs. 40*).—A general discussion upon the forests, forest species, and forestry in Oregon, paying particular attention to the species—their distribution, characteristics, and uses of the wood.

New Zealand trees and shrubs and how to identify them, H. H. ALLAN (*Auckland and London: Whitcombe & Tombs, 1928 pp. X+188, pls. 30, fig. 1*).—Technical descriptions are given.

Forestry and forest resources, Western Australia, S. L. KESSELL (*West. Aust. Forests Dept. Bul. 42* (*1928*), *pp. 28, pls. 2*).—A statement prepared for the British Empire Forestry Conference.

Forest tree planting, A. H. RICHARDSON (*Ontario Dept. Lands and Forests, Forestry Branch Bul. 1, rev.* (*1928*), *pp. 63, figs. 31*).—A revision of a previously noted bulletin (E. S. R., 51, p. 842).

Tree planting in Orange Free State, Griqualand West, Bechuanaland, and north-eastern districts of the Cape Province, J. D. M. KEET (*Union So. Africa Forest Dept. Bul. 24* (*1929*), *pp. 115, pls. 13*).—The principles and practices of growing forest trees are discussed, with notes on the characteristics and special requirements of various species.

The shelterbelt as an asset on the Iowa farm, I. T. BODE (*Iowa Agr. Col. Ext. Bul. 108, rev.* (*1924*), *pp. 16, figs. 12*).—A revision of a bulletin previously noted (E. S. R., 48, p. 448).

Windbreaks, H. H. Finnell (*[Oklahoma] Panhandle Sta., Panhandle Bul. 7 (1929), pp. 13, 14*).—Winds averaging around 15 miles per hour in velocity were found to produce a 10-day delay in the maturing of crops which had a 60-day growing period and also reduced yields.

Planting southern pine, P. C. Wakeley (*U. S. Dept. Agr. Leflet 32 (1929), pp. 8, figs. 4*).—Practical information is given on the selection of stock, methods of planting and subsequent care of trees.

Slash in chir pine (Pinus longifolia) forests: Causes of formation, its influence and treatment, J. E. C. Turner (*Indian Forest Rec., 13 (1928), No. 7, pp. [9]+46, pls. 25, fig. 1*).—Pointing out that the disposal of slash is a question of utmost importance in the chir forests because of their high inflammability during the dry season, the author outlines a constructive program of controlled burning which would avoid injury to the seed trees and prevent the serious losses now resulting from widespread fires.

DISEASES OF PLANTS

Handbook of plant diseases, I, II, founded by P. Sorauer (*Handbuch der Pflanzenkrankheiten. Berlin: Paul Parey, 5. ed., rev., 1924, vol. 1, pp. XVI+981, figs. 271; 1928, vol. 2, pp. X+758, figs. 195*).—The fourth edition of this work has been noted (E. S. R., 55, p. 242). Of the present edition (under the editorship of O. Appel, P. Graebner, and L. Reh), intended to comprise six volumes, the first, elaborated by Graebner, deals with nonparasitic plant diseases, and the second, brought to its present form in collaboration by G. Höstermann, E. Köhler, R. Laubert, M. Noack, E. Riehm, C. Stapp, and H. W. Wollenweber, deals with plant parasites.

Collective review of relations between host plant and parasites, III [trans. title], A. Zimmermann (*Centbl. Bakt. [etc.], 2. Abt., 69 (1927), No. 15–24, pp. 352–425, figs. 18; 70 (1927), Nos. 1–7, pp. 51–86; 8–14, pp. 261–313, figs. 4; 15–24, pp. 411–436*).—This series, now completed (E. S. R., 57, p. 146), represents the author's attempt to present for the use of German students of phytopathology a comprehensive and compact, though critically selective, account of what is known regarding the relations and processes involving plants and parasites causing plant diseases. This third part deals with Sclerotinia, Monilia, and Botrytis.

Plant pathology and therapy, T. Ferraris (*Trattato di Patologia e Terapia Vegetale. Parassiti Vegetali delle Piante Coltivate od Utili. Milan: Ulrico Hoepli, 3. ed., rev., 1926, vol. 1, pp. XIV+635, figs. 135; 1927, vol. 2, pp. VIII+641–1263, pls. 3, figs. 103*).—The present edition results from a complete revision, with enlargement, of the second (E. S. R., 33, p. 646).

Dusting for fungous diseases, W. M. Carne (*Jour. Dept. Agr. West. Aust., 2. ser., 4 (1927), No. 1, pp. 14–16*).—A brief general review is given of the composition and properties of dusts and of some of the advantages and disadvantages of dusting.

The correct time for application of spray fluids, H. R. Briton-Jones and A. H. Lees (*Jour. Min. Agr. [Gt. Brit.], 34 (1927), No. 9, pp. 814–817, pls. 8*).—Results of modern studies have more and more emphasized the need for use of winter and early spring protective sprayings at particular stages (dormant or developmental) of the plant. Since winters may differ considerably, these stages can not be related adequately to the calendar. The authors have, accordingly, attempted to define roughly the several stages for the purpose of making appropriate spray applications, for which names are proposed arbitrarily, as dormant, swelling, bursting, burst, green flower, and preflowering or pink. The

attempt has been made to include those stages which are most difficult to define. The several relevant stages are indicated with treatments in the case of apple, black currant, cherry, gooseberry, peach, pear, and plum.

A "deficiency disease": The lack of available manganese in a lime-induced chlorosis, B. E. Gilbert and F. T. McLean (*Soil Sci., 26 (1928), No. 1, pp. 27–31*).—In a discussion, partly bibliographical, of the deficiency disease resulting from the lack of available manganese, due to which a lime-induced chlorosis sets up, reference is made to relevant work and experiments carried out in 1926 and 1927, which are discussed in detail. Absence of chlorosis and increased yields were noted with tilled crops of corn, lettuce, onions, and mangels when manganous sulfate was applied, and hay varieties were also benefited. The evidence indicates that better results are obtained when the manganous salt is applied in solution.

Penicillium having fertile sclerotia [trans. title], W. Schwartz (*Ber. Deut. Bot. Gesell., 44 (1926), No. 10, pp. 648–652*).—The author describes the occurrence and behavior of Penicillium sclerotia found in a rotting orange in connection with the apparent or possible systematic position of the fungus form.

The physiology of Ustilago hordei [trans. title], E. Schaffnit (*Ber. Deut. Bot. Gesell., 44 (1926), No. 2, pp. 151–156*).—To details and opinions of investigational data and deductions of others, the author adds his own observations.

Heterothallism in Ustilago zeae, E. C. Stakman and J. J. Christensen (*Phytopathology, 17 (1927), No. 12, pp. 827–834*).—Pursuant to findings and suggestions from work previously noted (E. S. R., 59, p. 145), a study was planned of the possible rôle of hybridization and subsequent segregation in the origin of physiologic forms. In the meantime, however, as a result of field experiments, evidence was obtained of the existence of sexual strains.

U. zeae apparently is heterothallic. The fusion of two strains of opposite sex seems to be prerequisite to the formation of chlamydospores in the host plant. Corn inoculated with certain physiologic forms of *U. zeae* alone formed no smut galls, but when inoculated with one of such forms in combination with another form (presumably of opposite sex), smut galls formed on the hosts in a large percentage. Thus far, only two sexes have been evidenced. The fact that some physiologic forms alone cause gall formation suggests that these forms comprise morphologically isogamous but functionally heterogamous strains. No evidence was obtained that the sporidia of opposing sex strains fuse in artificial culture, though hyphal fusions and clamp connections were noted in plants which had been inoculated with two strains of opposite sex but not in those inoculated with unisexual strains alone, nor in those inoculated with combinations of strains of like sex. It is suggested that new physiologic forms are being produced by hybridization and consequent segregation. The production of sectors by certain unisexual strains suggests that new forms arise by mutation also.

Effects of fungous extracts upon the initiation and growth of the perithecia of Venturia inaequalis (Cke.) Wint. in pure culture, E. E. Wilson (*Phytopathology, 17 (1927), No. 12, pp. 835, 836*).—The stimulatory effect of fungus extract upon the production of perithecia by *Thielavia basicola* has been reported by McCormick (E. S. R., 54, p. 247). A similar stimulatory effect was observed by the present author when certain fungi occurred as contaminants in Petri dish cultures of *V. inaequalis*. A test is reported in which the addition of autoclaved (sterile) extract of a Penicillium showed a corresponding increase in the number of perithecia, and the addition of the not autoclaved extract showed a larger increase of perithecia. There was a slight

but perceptible stimulation both of perithecial and of mycelial development in the plates treated with the autoclaved Penicillium extract.

Infection conditions for cereal rust fungi [trans. title], G. GASSNER and G. O. APPEL (*Arb. Biol. Reichsanst. Land u. Forstw., 15 (1927), No. 3, pp. 417–486*).—This work dealt chiefly with the fungi *Puccinia dispersa*, *P. triticina*, and *P. coronifera* in their uredostages as influenced by the factors air humidity, temperature, and light, regarding each of which tabular and discussional details are given.

Moisture effect is related to temperature and time effect. It is claimed that depriving the whole plant of light lessens the degree of infection. Partial darkening of the leaves is, however, without result, provided the rest of the plant is in full daylight.

Copper powders for the prevention of bunt in wheat: Results of 1926 fungicide experiments, E. J. LIMBOURN and G. L. THROSSELL (*Jour. Dept. Agr. West. Aust., 2. ser., 4 (1927), No. 1, pp. 92–97*).—Copper carbonate, copper oxychloride (Smutol), and Vitrioline caused no injury to wheat seed as regards germination and early growth and did produce considerable improvement on the treated rows. Copper acetate slightly retarded germination. Copper carbonate and copper oxychloride, at the rate of from 1 to 1.5 oz. per bushel of seed, controlled a slight bunt infection. Smut-tipped seed required 2 oz. per bushel. Heavily bunted seed should be treated (if used at all) with copper sulfate or formalin. A tentative standard suggested for copper carbonate requires a copper content of not less than 50 per cent and a degree of fineness sufficient to pass the carbonate through a 200-mesh sieve in aqueous suspension.

Flag smut of wheat: Varietal resistance test, W. M. CARNE and E. J. LIMBOURN (*Jour. Dept. Agr. West. Aust., 2. ser., 4 (1927), No. 1, pp. 4–7*).—Wheat flag smut, present in Western Australia since 1921 and known to cause isolated crop losses of from 3 to 5 per cent each season, is relatively unimportant there as compared with ball smut or take-all, since it causes a total annual crop loss in the State of less than 0.25 per cent. It is, however, said to cause now in South Australia, Victoria, and New South Wales a loss each year of 3 per cent on the average, with local losses running frequently to 10 per cent and occasionally to 70 per cent of the total wheat crop.

Field observations in Western Australia since 1922 and the evidence of growers have shown definite susceptibility in certain varieties, particularly Gluyas Early and Merredin, and an equally definite resistance in Nabawa and Yandilla King. To test these and other varieties, experimentation was carried out in 1926 at the Merredin Experiment Farm. The results, which are tabulated with brief discussion, are said to confirm the varietal qualities above mentioned and to indicate the value of Nabawa and Bunyip as useful parents in the breeding of resistant varieties. Carrabin, Yandilla King, and Queen Fan are also considered as worth testing in this regard.

Conditions of germination and infection by Tilletia tritici [trans. title], H. RABIEN (*Arb. Biol. Reichsanst. Land u. Forstw., 15 (1927), No. 3, pp. 297–353, pl. 1, figs. 10*).—In this account of a study which dealt with the spore germination conditions in the case of *T. tritici* and the outbreaks, occurring under natural conditions, of stinking smut, it is pointed out by the author as a remarkable fact that the oxygen relation largely determines the behavior as a whole in spore germination. Consideration is necessary also of such factors as organic and inorganic solutions, the stimulating qualities of many substances, germination temperatures, and light, all in connection with oxygen relations, in their bearing upon the process of germination. Differences in outbreaks can be explained only by reference to the different conditions of spore germination,

and it is regarded as a necessary step, though difficult, to ascertain the combinations constituting limiting spore germination conditions for the different stinking smut outbreaks under varying external conditions.

Beet crown gall [trans. title], R. LIESKE (*Arb. Biol. Reichsanst. Land u. Forstw., 15 (1927), No. 2, pp. 261–270, pls. 2*).—Though the second isolation from beet crown gall gave an organism morphologically and physiologically in near agreement with *Bacterium tumefaciens*, the first isolations are said to have given forms showing important variations, which are described, with an account of the varietal results from inoculations. Conditions and means related to control are discussed.

The nature of resistance in Zea mays L. to Puccinia sorghi Schw., S. J. WELLENSIEK (*Phytopathology, 17 (1927), No. 12, pp. 815–825, pls. 2, fig. 1*).—Inoculations with two physiologic forms of *P. sorghi* on a large number of selfed lines of *Z. mays* having shown that a certain line was susceptible to one rust form and resistant to the other, while another line reacted oppositely, a histological study was made of the course of infection of one of the forms of the parasite on those two corn lines, and the differences are detailed.

In the susceptible host, after penetration, the fungus grows on immediately and progresses far, with abundant spore formation and no necrosis; whereas in the resistant host the parasite on entering forms an almost spherical substomatal vesicle and stops growing for about two days, then grows much more slowly than and not so far as in the susceptible host, forms only a few spores, and undergoes immediately afterwards a general necrosis, as do also the neighboring host cells. These differences are claimed to be quantitative and explainable on the assumption that the fungus, forming a few spores, dies from starvation and then excretes a substance which kills the host cells. Immunity appears to be nothing but extreme resistance. Physiologic specialization and resistance are considered as the two expressions of the host-parasite relation. No indication was found of the action of toxins and antitoxins, the nature of corn rust resistance thus appearing to be different from that in other rust fungi so far studied.

Studies in the biological and cultural characters of Capnodium sp. on cotton, A. SAWHNEY (*Jour. Indian Bot. Soc., 5 (1927), No. 4, pp. 141–186, pls. 13*).—Cotton grown from seed of Sea Island and American varieties planted in the Botanical Gardens at Lahore in May, 1925, showed in October dark specks of fungus growth at the midrib on the undersurface. This fungus was studied as to its behavior in the field, relations to the host, morphology, and physiology. The organism was identified as a species of Capnodium which has not been previously reported on cotton. It occurred along with Alternaria and Macrosporium on the leaves and bolls of cotton and is said to cause the black specks found on the glands. On inoculation, other parts of the plant are also affected. American and Sea Island cotton are reciprocally infected. The nonglandular variety is also susceptible. The organism lives on the secretions of the cotton plant and not on the honeydew of insects. Great injury is done to the host plant, both directly by destroying the cells and indirectly by lowering the vitality through exhaustion of the cells. Boll infection injures the fiber, apparently rendering the boll more susceptible to insect attack, especially in the case of Sea Island cotton.

Reproduction occurs chiefly by means of pycnidia. Oogonium and antheridium-like structures are produced in cover slip cultures. Pycnidia are variable, attaining their greatest length under natural conditions. Aerial mycelium develops abundantly in the higher concentrations of the (solid or liquid) media, but progressively less to zero as the concentrations are lowered. Other cor-

respondences are particularized. Light is essential for pycnidium formation at low temperature, but pycnidia form at 29° C. even in the absence of light. Cultures zonate under alternating light and darkness. Reduction of aeration lowers mycelial development and stops pycnidial formation. Air humidity increases the rate of spread of the fungus.

Plants susceptible or resistant to cotton root rot and their relation to control, J. J. TAUBENHAUS, B. F. DANA, and S. E. WOLFF (*Texas Sta. Bul. 393 (1929), pp. 30, figs. 5*).—A state-wide survey was made of cultivated and noncultivated plants to determine their susceptibility or resistance to root rot caused by *Phymatotrichum omnivorum*. Plants designated as resistant were either specially tested and found to be resistant or to have remained healthy in locations where root rot was destructive.

Among the cultivated plants, 274 species were found to be susceptible and 135 resistant. Among the susceptible plants were many of the more important field crops, tree and bush fruits, ornamental trees, shrubs, and vegetables. Marked resistance was shown by members of the melon, onion, lily, mint, asparagus, and grass families.

Among the noncultivated plants, 244 species were found to be susceptible and 66 resistant. Such weeds as the common tievine, soft groundcherry, and several species of Solanum were found to be susceptible, and because of their perennial nature they serve as important carriers of root rot.

Cotton wilt studies.—II, Preliminary studies on wilt resistance and on the effect of certain soil factors on the development of cotton wilt, V. H. YOUNG, J. O. WARE, and G. JANSSEN (*Arkansas Sta. Bul. 234 (1929), pp. 32, figs. 8*).—In continuation of studies on cotton wilt (E. S. R., 59, p. 640), the authors give accounts of comparative tests of varieties of cotton for resistance to wilt and of physiological studies of the cotton plant and the wilt fungus as influenced by environmental conditions.

Two years' tests showed a high degree of wilt resistance in some varieties, even when root knot was a complicating factor. Some of the varieties are said to have desirable characteristics, and these varieties are tentatively recommended for planting on wilt infested land in Arkansas.

Laboratory studies showed that organic fertilizers applied in the form of green manure did not function in reducing cotton wilt, and that nitrate production in green manured soils was greater than in soils fertilized with an inorganic nitrate fertilizer even when the soil in both cases was inoculated with *Fusarium vasinfectum*. Ammonia and nitrate determinations of soil fertilized with organic and inorganic nitrogen showed no correlation with percentages of wilt secured. The strain of the cotton wilt fungus used was found not to function as a reducing organism when grown in a solution using inorganic salts as a source of nitrogen.

[Diseases of cotton, Egypt] (*Egypt Min. Agr., Cotton Research Bd. Ann. Rpt., 5 (1924), pp. 36–41*).—In the cotton sore shin prevention tests reported Sakel C/23 cottonseed treated with Germisan (25 per cent) came up decidedly better than did the controls, with Uspulun (25 per cent) as a close second-best treatment. Naphthalene (3 per cent) and copper carbonate (2 per cent) showed hardly any protective value. A study of the Fusarium disease of cotton showed the parasitism of the Egyptian Fusarium isolated from different parts of diseased cotton plants originating in 4 Provinces, with other details, including behaviors of cottons varietally, and of Fusariums from different geographical areas. The filtrate of liquid culture medium used for Egyptian Fusariums was found to cause wilting of cotton seedlings, the time required for this effect varying with the age of the culture.

The downy mildew of the hop in 1927, E. S. Salmon and W. M. Ware (*Jour. Min. Agr.* [*Gt. Brit*], *34* (*1928*), *No. 12*, *pp. 1093–1099*).—This article contains a brief account of the course of hop downy mildew in England in 1927, a consideration of the sources of infection in connection with control by spraying and other measures, and an estimate of the losses during the year. In the wet season of 1927, preventive removal of "spiked" growths, etc., proved insufficient to prevent a widespread outbreak of the disease.

Spraying with Bordeaux mixture (which is said to have proved satisfactory on the Continent) is recommended, and four applications are tentatively suggested.

As regards the cones, certain varieties, e. g., Bramling and Tolhurst, have proved to be especially susceptible, while Fuggles, under severe conditions, has proved to be practically immune.

Chemical aspects of disease resistance in the onion, J. C. Walker, K. P. Link, and H. R. Angell (*Science*, *69* (*1929*), *No. 1795*, *p. 555*).—Previous investigations have shown that resistance of varieties of onions to smudge, caused by ***Colletotrichum circinans,*** is associated with pigments in the bulb scales (E. S. R., 56, p. 450). A chemical study of the water-soluble substances in the pigmented scales is reported to have shown that one of the toxic entities is the phenolic acid commonly known as protocatechuic acid. This has been isolated from pigmented scales in a pure crystalline form. The toxicity of protocatechuic acid to the fungus has been established, and the authors consider that it is one of the chief constitnents responsible for the marked resistance exhibited by the pigmented onion to the smudge disease.

The classification of certain virus diseases of the potato, J. Johnson (*Wisconsin Sta. Research Bul. 87* (*1929*), *pp. 24*, *figs. 6*).—The author states that the investigations reported in this publication were undertaken primarily for the purpose of securing further information on the nature and identity of the virus normally present in apparently healthy potatoes. The virus diseases studied were crinkle mosaic, rugose mosaic, leaf rolling mosaic, and mild mosaic. Attention was also given to a study of the spot necrosis virus, its relation to rugose mosaic, and to mottle as secured from healthy potatoes. Studies were made of the different kinds of viruses with respect to longevity in vitro, thermal death point, tolerance to dilution, varietal susceptibility, and symptom expression. The viruses as a whole were found to be very sensitive to unfavorable conditions as compared to the virus of tobacco mosaic. They lost their virulence rapidly, were destroyed by relatively low temperatures, had a comparatively low tolerance to dilution, and showed marked differences in their effect on different varieties of potatoes.

The author presents evidence which is said to point toward the identity of true rugose mosaic with spot necrosis and the probable existence of this disease in an attenuated form in practically all apparently healthy potatoes of the standard varieties.

Mosaic and leaf roll of potatoes, W. H. Carne (*Jour. Dept. Agr. West. Aust.*, *2. ser.*, *4* (*1927*), *No. 2*, *pp. 322–329*, *figs. 4*).—The virus diseases best known in Australia are those of mosaic and leaf roll of potatoes, bunchy top, said to be the most serious disease of bananas, and almost certainly spotted wilt of tomatoes. Potato mosaic and leaf roll are described as causing losses locally, but as effectively controlled by the use of certified seed or seed from selected plants in good disease-free crops or from carefully culled seed plats.

Potato canker, I–III [trans. title], E. Köhler (*Arb. Biol. Reichsanst. Land u. Forstw.*, *14* (*1926*), *No. 3*, *pp. 267–290*, *pl. 1*, *figs. 21*; *15* (*1927*), *Nos. 2*, *pp. 135–176*, *pls. 3*, *figs. 30*; *3*, *pp. 401–416*, *pl. 1*).—The present series follows

up a relevant contribution, which has been noted (E. S. R., 54, p. 546). Of the three numbers of the present series, the first deals in detail with the potato tuber galls produced by *Synchytrium endobioticum* and with infection tests, the second with gall reaction and abortive reaction (subinfection) and varietal differences in susceptibility in connection with reaction phenomena, and the third with infection tests on resistant or on susceptible varieties. Results are shown of infection with *S. endobioticum* as regards both cell and tissue reaction.

Injuries to potatoes by Fusaria [trans. title], E. SCHMIDT (*Arb. Biol. Reichsanst. Land u. Forstw., 15 (1928), No. 5, pp. 537-592, pls. 7*).—As causing potato dry-rot the author established *Fusarium coeruleum* to be quite virulent, with *F. viticolum* and *F. avenaceum* much less injurious. On the verge of parasitism stands *Gibberella saubinetii*. *F. solani*, commonly stated in the literature to be parasitic, is here claimed to be a harmless saprophyte. *F. coeruleum* attacks at temperatures above 10° C. and *F. viticolum* and *F. avenaceum* above 2.5°. Inoculation with *F. coeruleum* succeeds at humidities above 50 per cent, the other two at readings not lower than 80 per cent. Under favorable conditions, *F. coeruleum* completely destroys tubers of the variety Up-to-Date in from 4 to 6 weeks, the other two species only after from 2 to 3 months. These three are all typical wound parasites. Inoculation does not always succeed. Age may enter as a factor in determining infection. Other potatoes show differences in degrees of susceptibility, which are small in *F. coeruleum* and large in *F. viticolum* and *F. avenaceum*. These differences are much accentuated in cases of low temperature and low humidity.

The life tenure of species of Fusarium in dry condition is very high, in some cases from 6 to 7 years.

Necrosis and other phloem degeneration phenomena in potato [trans. title], SCHANDER and BIELERT (*Arb. Biol. Reichsanst. Land u. Forstw., 15 (1928), No. 5, pp. 609-670, pls. 4*).—In the phloem of potato degenerative alterations occur which are here divided into acute necrosis, senile necrosis, necrobiosis, and obliteration. The first named is of pathogenic origin. The others are associated more or less with aging. Necrobiosis and obliteration are not sharply differentiated. These conditions are discussed in relation to potato and related forms.

Seed treatment control of Rhizoctonia of potatoes in Idaho, J. M. RAEDER and C. W. HUNGERFORD (*Phytopathology, 17 (1927), No. 12, pp. 793-814, figs. 5*).—Experimentation conducted in 1924 and in previous years (E. S. R., 55, p. 653) with potato seed treatments for Rhizoctonia was continued, though somewhat modified as to treatments and with considerable emphasis on presprinkling.

Of the treatments used in 1925 (31 including checks), the best was that using Semesan Dust applied at the rate of 2 oz. per bushel to presprinkle seed. Of the treatments (55, including checks) in 1926, that giving the best control was a 4-minute dip, after presprinkling, into a 1:120 formalin solution at 125° F. Tests in 1925 with Dupont Dust No. 15, which had proved satisfactory in 1924, gave no results at all comparable with those previously obtained. Disease readings were based upon sclerotia on the tuber surface at harvest rather than upon stem lesions during the growing season.

Studies on the rice blast disease, Y. NISIKADO (*Japan. Jour. Bot., 3 (1927), No. 3, pp. 239-244*).—A report on this work has been noted (E. S. R., 40, p. 156). The purpose is to continue the investigation, which as a whole thus far includes morphological, physiological, and taxonomic studies of the causal fungus of rice blast and of species related thereto; the relation of such environmental factors as climate, soil, or manures to outbreaks; the selection of blast-resistant rice varieties: and physicochemical studies of the resistance of rice to blast.

This disease, reported to occur in all rice-producing regions of the world, is said to be one of the most serious menaces to the rice industry in Japan. To the nine hosts previously known, the present paper adds three. The generic name Piricularia is preferred to Dactylaria, which also has been used. Inoculation studies are indicated. Some relation may exist between the pH values and pathogenicity. Most of the strains of *P. oryzae* grow on media at pH 5.0 to 10.0. *P. setariae* shows much the same reaction range. In culture the *Piricularia* spp. lasted for more than 400 days. The spores retained viability from autumn to summer. When adhering to rice glumes, they may be easily sterilized, requiring for this only dilute fungicides. The mycelium is difficult to kill after it penetrates. *Piricularia* spp. could not grow in carbon dioxide, or without oxygen supply.

Season and weather are the most important environmental conditions for the occurrence of rice blast. The return of normal June and July weather after continued chill and rain conditions severe blast outbreak. So-called rotten neck is caused by cool, damp conditions during the blooming season in September. Quality and quantity of manures are the next most important factors in connection with rice blast disease outbreak, which is most severe when heavy green manuring has been employed. Though leaf blast occurs in fields of heavy loam or clay soil, rotten neck occurs in well drained sandy soil, as if favored by this condition.

Numerous varieties are listed as resistant, but none as immune. No very consistent correlations were established between resistance and the pH of the leaf juice, though it is stated that the resistance shown by some varieties was associated with acidity.

Comparative studies on Helminthosporium diseases of rice in the Pacific regions, Y. Nisikado (*Ber. Ōhara Inst. Landw. Forsch., 3 (1927), No. 4, pp. 425–440, pls. 5, fig. 1*).—Results are given of comparative studies on strains of *Helminthosporium oryzae*, the cause of rice leaf spot in the Pacific regions. Comparisons were particularized between Japanese and American strains, both of which produced conidia in culture and gave lesions practically alike in general appearance, though these strains showed clear contrasts as to morphological characters, especially in conidial forms described. Physiologically, also, contrasts are apparent. No great differences in pathogenicity to rice seedlings were shown. The two fungi are regarded as distinct forms and ranked as possibly distinct species.

Smut on broom millet and other sorghums, W. M. Carne (*Jour. Dept. Agr. West. Aust., 2. ser., 4 (1927), No. 3, p. 348*).—It is stated that smut (*Sphacelotheca sorghi*) had been reported in 1927 as found on a broom millet crop in the Great Southern district, and also in 1926 as on kafir corn in the Southwest.

Mosaic of sugar-cane in Peru, E. V. Abbott and G. N. Wolcott (*Science, 69 (1929), No. 1788, p. 381*).—As a result of a survey, the first author claims that the mosaic disease of sugarcane is present in only one valley in Peru. There it is generally distributed on all plantations. The disease is believed to have been introduced about 1920 on diseased sugarcane stalks from Argentina.

The second author made a study of the aphids occurring in cane fields, and while he found *Sipha flava* present on sugarcane throughout the northern valleys of Peru, it is not believed to be connected with the transmission of the virus of the mosaic disease. The corn aphid (*Aphis maidis*) was noted on various grasses in the cane fields, particularly *Arundo donax*, which commonly grows along ditch banks in the cane fields. The aphid is also abundant on corn, but it is believed that only those individuals which occur on grasses in the cane fields are concerned in the spread of the disease on sugarcane.

Some significant properties of the virus of typical tobacco mosaic, B. M. DUGGAR (*Science, 69 (1929), No. 1795, p. 555*).—The author claims to have determined the temperature relations of the mosaic virus of tobacco by a method which eliminates the usual lag in temperature effects. Determinations of the relation of the virus to chemical agents, as well as to solutions of high concentration, are considered to denote an agency with a stability above that of the bacterial vegetative cell, but distinctly more sensitive than the typical spore of bacteria. Adsorption and oxidation studies are said to confirm previous reports of the colloidal properties of the virus, while resistance to enzymic action is a property of special significance.

Apple spraying experiments in 1926 and 1927, D. FOLSOM and T. T. AYERS (*Maine Sta. Bul. 348 (1928), pp. 145–176, figs. 2*).—An account is given of apple-spraying experiments carried on in 1926 and 1927 in continuation of those previously reported (E. S. R., 56, p. 151).

Tests were made of lime sulfur and sulfur dusts applied in accordance with various spray schedules. The results are said to indicate that the prepink application might reduce scab without being necessary for good control, and that in one season the prepink, pink, 4-week, and August applications each helped to reduce scab, with less scab present as more applications were made. Tree variation is said to have prevented significant effects from any single application. Extending the investigations into the winter showed that scab in stored fruit can result from infection occurring before the August application, but when severe it is considerably reduced by the August application. Slight differences in storage temperatures near 32° F. did not affect storage scab consistently. Lesions that were apparent at packing time were said to have not enlarged in storage. Handling at packing time was not found to transmit the disease.

Leaf burning on both Ben Davis and McIntosh trees was increased by spraying, especially in the later applications. Fruit russeting was more severe in Ben Davis than in McIntosh. With more frequent spray applications fruit russeting was increased, but at the same time scab was decreased sufficiently to give a net gain in the percentage of clean fruit. The authors claim that the variety McIntosh needs more spraying and can endure more than the Ben Davis. Sulfur dust was found to prove disappointing, although it reduced fruit scab more than leaf scab. It also increased fruit russeting. In the variety McIntosh, twig infection was found to frequently cause severe infection of leaves and fruits, even in spite of spraying.

The authors claim that general observations and experiments in commercial orchards show that there is too much variation in spraying schedules, equipment, and other conditions to permit any generalizations with regard to scab differences.

It is concluded that specific expert advice regarding the seasonal and local modification of schedules will be found either expensive or disappointing.

The relation of woolly apple aphis to perennial canker infection with other notes on the disease, L. CHILDS (*Oregon Sta. Bul. 243 (1929), pp. 31, figs. 11*).—Studies carried on in the Hood River Valley from 1925 to 1928 are said to have shown that the perennial canker *Gloeosporium perennans* is a wound parasite and is not truly perennial. The woolly aphis was found to be definitely associated with canker infection, and the extent of the advance of the fungus depended to a large degree on winter temperatures, those below zero Fahrenheit favoring infection through the rupturing and collapsing of aphis galls on thawing. Pruning wounds were found to be potential canker centers, as they are liable to woolly aphis attack. Various sprays applied to

canker-bearing trees were found ineffective for the complete control of either the aphis or the perennial canker.

For the control of woolly aphis and perennial canker in the main framework of the trees, the author recommends tree surgery, painting the wounds, and spraying. Pruning during winter was found to be followed by infection, but there was little or no infection of wounds made by pruning early in the spring or later in the season. Cutting to stubs on the main framework of the tree is recommended. Quickly drying paints that form an inelastic covering should not be used.

The varietal susceptibility of commercial apple trees to perennial canker is pointed out. Northern Spy, red sports of Delicious, and others are said to be quite resistant to attack.

The perennial canker fungus is said to cause a disease of stored fruit known as bull's-eye rot.

The occurrence and prevention of calyx injury in apples from the Hood River Valley, H. Hartman, L. Childs, and R. H. Robinson (*Oregon Sta. Bul. 242 (1929), pp. 24, figs. 8*).—A type of calyx injury of apples in the Hood River Valley region of Oregon is described that is said to differ from injuries caused by fungi, oil sprays, or sunburn. It was found to be caused by applications of arsenicals and was most severe in fruit that had been exposed to prolonged wet weather after picking. While most severe in heavily sprayed fruit, the trouble was found to occur in apples that had received only moderate or small amounts of spray. Under Hood River conditions calyx injury was often accompanied by decay from various fungi.

The authors' studies are said to have shown that acid liberated by the apple itself may contribute to the solubility of arsenic compounds in the calyces of the apple. The injury is said to be usually more severe in fruit held in common storage than in that held in cold storage. Calyx injury was found to be reduced in both washed and unwashed apples when hydrated lime or Bordeaux mixture containing an excess of lime was used in conjunction with the arsenicals. Some calyx injury attributed to the washing process was found to be due primarily to arsenic rendered soluble by the washing compounds or by prolonged exposure to moisture. Arsenicals remaining in the calyces seemed to be a more common cause of calyx injury in washed apples than arsenic accumulating with repeated use of the washing solution. It is suggested that the addition of hydrated lime to rinse water would be effective in reducing injury when the acid process is used.

Pear scab (Venturia pirina), A. Flintoff (*Jour. Dept. Agr. West. Aust., 2. ser., 4 (1927), No. 2, pp. 248–250*).—To test the efficacy for controlling pear scab of commercial Bordeaux mixture (Schloesing's) at different strengths and periods, an experiment (here credited to the direction of G. W. Wickens) was carried out at Bridgetown. From the results, which are admittedly inconclusive, it appears that spraying with Bordeaux mixture in autumn is ineffective, and that spraying at the pink stage with Bordeaux mixture at a strength of 2 lbs. of the commercial mixture to 7 gal. of water (though effective in controlling the scab) injures the foliage and russets the fruit.

A further experiment, testing the advisability of using lime sulfur at a strength greater than that used in certain previous tests and using on Vicar and Bartlett pear trees commercial lime sulfur at a strength of 1 gal. to 8 gal. of water, when leaf and blossom buds began to swell and once again in the forward pink stage, proved satisfactory as russeting and scab were practically absent. The burning of the first delicate leaves was slight and was not reported after the second spraying.

Veined variegation in Evonymus japonicus and E. radicans [trans. title], V. RISCHKOW (*Biol. Zentbl., 47 (1927), No. 12, pp. 752–764, figs. 3*).—A supposed variant of *E. japonicus* is said to be due really to an infectious chlorosis, and the same may be true in the case of a supposed variant of *E. radicans*.

A new disease of Douglas fir, N. O. HOWARD (*Science, 69 (1929), No. 1799, pp. 651, 652*).—A brief account is given of a disease of the Douglas fir, *Pseudotsuga taxifolia*, observed in 1927 in Rhode Island. The causal fungus of the disease is considered to be a species of Dasyscypha, and it has been studied in connection with *D. willkommii*, the cause of larch canker. In addition to the locality where the disease was originally discovered, it has been found at several places in Massachusetts.

Corrosive and destructive wood decomposition and its biological significance [trans. title], R. FALCK (*Ber. Deut. Bot. Gesell., 44 (1926), No. 10, pp. 652–664, pl. 1, fig. 1*).—Systematic discussion of a few wood-destroying fungi is followed by tabulation of the results of attack on conifer wood by *Polyporus annosus* and *Merulius domesticus*.

Carbon disulfide emulsion for the control of a nematode, P. J. CHAPMAN and M. M. PARKER (*Science, 70 (1929), No. 1801, p. 18*).—The authors report the successful use of an emulsion of carbon disulfide for the control of nematodes in greenhouse soil. The emulsion used is similar to that recommended for the control of larvae of the Japanese beetle and the Asiatic beetle. An emulsion containing approximately 0.7 per cent of carbon disulfide freed infested soil of nematodes under the conditions tested. Applications were made at the rate of 1 gal. of the diluted emulsion to each cubic foot of soil, and soil in pots and in greenhouse benches was successfully treated. The minimum dosage for a given unit of soil for commercial control, the range of efficiency for various types and conditions of soil and the stage and location of the nematode, and the cost of the treatment are yet to be determined.

Nematode control [trans. title], H. GOFFART (*Arb. Biol. Reichsanst. Land u. Forstw., 15 (1927), No. 2, pp. 249–259*).—The beet nematode (*Heterodera schachtii*) was fairly well controlled by calcium cyanide solution when this was applied at the rate of 200 gm. per square meter and at a strength of 1 per cent. A slight beneficial effect at 0.1 per cent could be counteracted by activating materials and elevation of temperature. At 0.01 per cent no control effect was obtained.

ECONOMIC ZOOLOGY—ENTOMOLOGY

The Bureau of Biological Survey: Its history, activities, and organization, J. CAMERON (*Inst. Govt. Research, Serv. Monog. U. S. Govt. No. 54 (1929), pp. X+339, fig. 1*).—This monograph, prepared by the Institute for Government Research, deals at length with that work of the U. S. Department of Agriculture which was organized as the Division of Economic Ornithology and Mammalogy in 1886, later as the Division of Biological Survey, and since 1905 as the Bureau of Biological Survey. A complete list of the publications issued from 1886 to 1928 is included, as are a digest of the laws relating to the Survey and its work and a bibliography of 174 titles.

Laws and regulations relating to game, land fur-bearing animals, and birds in Alaska, 1929–30 (*U. S. Dept. Agr., Bur. Biol. Survey, Alaska Game Comn. Circ. 6 (1929), pp. II+30, figs. 2*).—This is the usual annual compilation (E. S. R., 60, p. 355).

Field book of North American mammals, H. E. ANTHONY (*New York and London: G. P. Putnam's Sons, 1928, pp. XXV+625, pls. 49, figs. 150; rev. in Jour. Mammal., 9 (1928), No. 3, p. 257*).—This field book gives descriptions of

every mammal known north of the Rio Grande, including 1,445 species and subspecies, together with brief accounts of habits, geographic ranges, etc. It contains 32 colored plates and 175 photographs, pen-and-ink sketches, and maps. A reproduction in colors of the fourth provisional zone map of North America, by the U. S. D. A. Bureau of Biological Survey, is attached.

The review is by H. H. T. Jackson.

A rat and a rat-flea survey of ships at the port of New York, C. L. WILLIAMS (*Pub. Health Rpts.* [*U. S.*], *44* (*1929*), *No. 9, pp. 443–476, fig. 1*).—This is a report of ships' rats and fleas as they are concerned in the transfer of bubonic plague, with particular reference to maritime quarantine. The most important finding is that the majority of rats are carried by relatively few ships and that, conversely, the majority of ships carry few rats. From a quarantine standpoint at New York about 50 per cent of arriving ships constitute about 90 per cent of the potential plague menace. Only about 10 per cent of these ships are heavily infested (over 30 rats), and these are really the potentially dangerous vessels. Next in importance is the observation that at New York only two varieties of rat flea are found on ships in sufficient numbers to be of importance in the transmission of plague. These are *Xenopsylla cheopis* and *Ceratophyllus fasciatus*.

On the anatomy of the nematode Passalurus ambiguus (Rudolphi), B. L. DANHEIM and J. E. ACKERT (*Amer. Micros. Soc. Trans.*, *48* (*1929*), *No. 1, pp. 80–85, figs. 15*).—This contribution from the Kansas Experiment Station reports upon the anatomy of a small oxyurid found in the cecum of the cottontail or common wild rabbit. The specimens from which these studies were made came from rabbits in the vicinity of Manhattan, Kans., Baltimore, Md., and Lincoln, Nebr.

Review of United States patents relating to pest control, [January–December, 1928], R. C. ROARK (*U. S. Dept. Agr., Bur. Chem. and Soils, Rev. U. S. Pat. Relat. Pest Control, 1* (*1928*), *Nos. 1, pp.* [*2*]+*13; 2, pp. 11; 3, pp. 15; 4, pp. 15; 5, pp. 16; 6, pp. 21; 7, pp. 21; 8, pp. 23; 9, pp. 11; 10, pp. 14; 11, pp. 11; 12, pp. 14*).—In this review the author has brought together abstracts of patents relating to pest control, in order that materials and methods useful for this purpose may be available for interested parties. The term pest as here used includes all organisms, plant or animal, which are economically harmful to man.

Recent progress in the chemistry of Derris, R. C. ROARK (*Jour. Econ. Ent.*, *22* (*1929*), *No. 2, pp. 378–381*).—"The insecticidal principle of the root of *Derris elliptica* is 'rotenone,' a white crystalline material, $C_{23}H_{22}O_6$, melting point 163° C., soluble in ether, acetone, and oils, but insoluble in water. It contains two methoxyl groups and a ketone group, but its constitution is as yet unknown. It was called rotenone, from the Japanese name of the plant 'Roh-ten,' by Nagai, who first isolated it in 1902.

"Dried Derris root contains from 0.5 to 6 per cent rotenone. Rotenone is stable in the dried root or in solution in oil, but decomposes on contact with water or alkalies. For this reason soap emulsions containing rotenone should be prepared only shortly before using. According to Japanese experimenters, rotenone decomposes within 2 days after application to foliage, and hence vegetables sprayed with it may be subsequently eaten with impunity.

"In connection with a study of the constitution of rotenone, the insecticide division of the Bureau of Chemistry and Soils has prepared from the Derris literature about 250 abstracts, many of which are from sources not readily available."

Mercury salts as soil insecticides, H. GLASGOW (*Jour. Econ. Ent.*, *22* (*1929*), *No. 2, pp. 335–340*).—"Various salts of mercury have been found effective in

checking injury by such soil-inhabiting pests as the cabbage maggot (*Hylemyia brassicae*), the carrot rust fly (*Psila rosae*), and the onion maggot (*H. antiqua*). Of the various compounds examined mercurous chloride is especially noteworthy, as much on account of its great safety to the crop treated as because of its efficiency as an insecticide. Mercurous chloride promises to be an exceedingly useful insecticide, particularly in the treatment of tender crops such as cauliflower and celery seed beds as well as in certain types of greenhouse work. In addition to its insecticidal properties, mercurous chloride also appears to have considerable fungicidal value in checking certain seed bed diseases."

Deterioration of soap-nicotine preparations, II, C. C. McDonnell and J. J. T. Graham (*Indus. and Engin. Chem., 21 (1929), No. 1, pp. 70–73, figs. 2*).—This is a contribution from the U. S. D. A. Food, Drug, and Insecticide Administration in continuation of that previously noted (E. S. R., 52, p. 309).

It is concluded that "soap-nicotine preparations ordinarily found on the market decrease in nicotine content on storage. Hard soda soaps lose nicotine more rapidly on exposure to the air than potash soaps. However, soft soda soaps and potash (soft) soaps lose it at about the same rate. Excess of alkali or fat in the soaps has no appreciable influence on the rate of loss of nicotine. The loss of nicotine from soap-nicotine preparations made with drying oils (fish oils, cottonseed oil, linseed oil) and packed so that air is not excluded is due mainly to oxidation, the nicotine with part of the fatty acids of the soap being converted into an insoluble condensation product of indefinite composition. The loss of nicotine from soap-nicotine preparations made with nondrying oils (oleic red oil, stearic acid) and stored without air being excluded is due to volatilization of nicotine, no insoluble condensation product being formed. Both hard and soft soaps, whether made from drying or nondrying oils, when packed so that they were completely protected from the air, suffered no loss in nicotine content during two years of storage."

The growth of the foliage and fruit of the apple in relation to the maintenance of a spray coating, C. C. Hamilton (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 387–396, figs. 6*).—In this contribution from the New Jersey Experiment Stations the author shows that a direct relation exists between the increase in leaf area and the decrease in the arsenical residue upon the leaves. The rapidity of the decrease in arsenical residue is proportional to the rapidity of increase in the leaf area. The greater part of the foliage had developed by the time the last spray was applied, on June 29, therefore the loss in arsenical residue after that date was due mostly to weathering conditions. The decrease in the arsenical residue upon the apples is also directly proportional to the increase in surface or volume growth.

A correlation between oil surveys and chlorophyll content of foliage, J. M. Ginsburg (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 360–366*).—This is a contribution from the New Jersey Experiment Stations.

"Two varieties of apple trees received several spray applications of a highly refined lubricating oil during the months of July and August. No injury to foliage or fruit was observed from these late sprays. The leaves on these trees were darker green, appeared more vigorous, and exhibited a later leaf drop than those of either unsprayed trees or trees which received other sprays. Chemical analysis disclosed the fact that the oil-sprayed leaves of both varieties contained appreciably more chlorophyll than did the leaves from the unsprayed trees."

A study of water-miscible mineral-oil preparations, textile oils, leather oils, metal cutting oils, etc., R. Hart (*Indus. and Engin. Chem., 21 (1929), No. 1, pp. 85–90, figs. 4*).—"It is shown that the manufacture of clear water-

miscible or 'soluble' mineral oils is primarily a problem in miscibility, and that free oleic acid is essential to a uniform product. Miscibility curves for several emulsifiers, mineral oil, and oleic acid are given, by means of which uniform and nonuniform mixtures were traced. Free oleic acid decreases the stability of the emulsion, and may even prevent it altogether. . . .

"It is shown that the kind and quantity of mineral oil have practically no effect on the quantity of oleic acid that the mixture will tolerate and still give a good emulsion. This factor, on the other hand, varies with the kind of emulsifier, and even with the same type of emulsifier, provided it is subject to adjustments. It is further shown that alcohol has the following effects: (1) Acts as a liquefier for the soap; (2) at first decreases and then, as more alcohol is added, increases the quantity of free oleic acid required for a homogeneous product; and (3) exerts no direct effect on the emulsion. The addition of alkali to a soluble oil containing acid-sulfonated oil as the emulsifier yields the following results: (1) In the absence of alcohol it at first decreases and then increases the quantity of free oleic acid required for a homogeneous product; (2) in the presence of sufficient alcohol, the more alkali the less oleic acid required to clear; and (3) the more neutralized the sulfonated oil the better it functions as emulsifier, the completely neutralized oil being the best in this respect."

Methods are outlined for testing the stability of soluble oils, which may also be of service in stabilizing such oils during manufacture.

The action of sulphur as a fungicide and as an acaricide, Part II, W. Goodwin and H. Martin (*Ann. Appl. Biol., 16 (1929), No. 1, pp. 93–103, fig. 1*).—The conclusion arrived at by chemical methods, that the volatile agent produced when sulfur is applied to a heated surface is gaseous sulfur, was subjected to biological tests in which the fungi *Erysiphe graminis* and *Sphaerotheca humuli* and the gall mite *Eriophyes ribis* were employed.

"It was shown that the agent present in air passed over heated sulfur and responsible for the death of the gall mite was not removed by filtration through a heated glass-wool plug, this observation being contrary to the view that the toxic agent is produced initially in solid form. Filtration through a cooled glass-wool plug only removed part of the volatile agent, and it was shown that the gall mite is affected by the traces of sulfur volatilized at ordinary temperatures. The results of the experiments with the gall mite were in complete accord with those obtained in the previous chemical work. At relatively large concentrations sulfur dioxide and hydrogen sulfide are without permanent effect upon the gall mite, and these gases are therefore not responsible for the acaricidal action of sulfur."

Maximum weights of various fumigants which can exist in vapor form in a 1,000 cubic foot fumigating chamber, R. C. Roark and O. A. Nelson (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 381–387*).—The authors present formulas by the use of which the maximum number of pounds of a fumigant, whether gas, liquid, or solid, which can exist in the vapor phase in an inclosed space of 1,000 cu. ft. at a temperature ranging from 32 to 122° F. under a pressure of 1 atmosphere can be calculated. Tables are given with data for 26 compounds, including such commonly used fumigants as hydrocyanic acid gas, carbon disulfide, paradichlorobenzene, naphthalene, nicotine, etc.

Tolerance of different species and varieties of plants to naphthalene vapor, A. Hartzell (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 354–359, pl. 1*).—"One hundred and fifty species and varieties of plants were tested to determine their tolerance to naphthalene fumigation with concentrations of 1.5 oz. and 2 oz. for each 1,000 cu. ft. of greenhouse space. Dahlia proved to be one of the most tolerant species. Single fumigations at the higher concentration were effective

in the control of red spider (*Tetranychus telarius*), two species of thrips (*Heliothrips femoralis* and *Thrips tabaci*), and a slug (*Limax maximus*). At the lower concentration repeated fumigations at intervals of 4 or 5 days were necessary to obtain satisfactory control."

Determining hydrocyanic acid gas concentration in fumigation experiments, C. O. EDDY and E. N. GEDDINGS (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 366–378, figs. 5*).—A contribution from the South Carolina Experiment Station.

"The concentration of hydrocyanic acid gas in a large room fumigated with CyaLogas calcium cyanide was determined by removing fixed quantities of air during definite periods at selected times by an aspirator system, passing the samples through small volumes of 3.5 per cent sodium hydroxide solutions, and calculating the parts per million from analytical results secured by using a modification of the Liebig method. No consistent difference was noted in the concentration of gas at different elevations. The rate of decrease was directly proportionate to the initial concentrations. The decrease was also most clearly marked during the first five hours. Higher initial concentrations of gas per unit of calcium cyanide were derived from lower dosages. An increase in concentration usually occurred during the first two or three hours with dosages above 4 oz. per 1,000 cu. ft."

The hot-water treatment of nursery plants, W. E. FLEMING and F. E. BAKER (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 314–317*).—The hot-water treatment to destroy the immature stages of the Japanese beetle (E. S. R., 60, p. 562) was applied to 164,000 nursery plants of 59 species during the dormant season of 1927–28. Twenty-six species were treated successfully. The treatment retarded slightly the development of 3 species and more or less severely injured 30 species. The cause of the failure of the treatment of many varieties in the nursery is not as yet definitely established.

The principles of systematic entomology, G. F. FERRIS (*Stanford Univ. Pubs., Univ. Ser., Biol. Sci., 5 (1928), No. 3, pp. 169, figs. 11; rev. in Ent. News, 40 (1929), No. 2, pp. 64–66*).—This is primarily a discussion of the fundamental principles and philosophical background of systematic entomology. The several chapters deal with the contribution of the systematist to biology (pp. 9–17), the scope of systematic biology (pp. 18–23), the principles of systematic entomology (pp. 24–35), the segregation of species (pp. 36–50), categories less than the species (pp. 51–57), the morphological basis of systematic entomology (pp. 58–65), the preparation of material (pp. 66–75), entomological drafting (pp. 76–99), the description of species (pp. 100–107), classification (pp. 108–127), nomenclature (pp. 128–157), and the training of the systematist (pp. 158–163). A reprint of the International Code of Zoological Nomenclature,[3] given in a bulletin by Stiles (E. S. R., 17, p. 378), is included (pp. 135–157). The review is by W. L. McAtee.

The chemical senses of insects, D. E. MINNICH (*Quart. Rev. Biol., 4 (1929), No. 1, pp. 100–112*).—This account is presented in connection with a list of 40 references to the literature.

[Notes on economic insects] (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 420, 421, 422–425*).—The notes relating to economic insects here presented include the following: Field Corn Injured by Larvae of *Sidemia devastatrix*, by T. L. Guyton and J. R. Stear; *Supella supellectilium* (Seville), a Household Pest in Nebraska, by D. B. Whelan; Hickory Leaf Gall Midges, *Caryomyia* species, by E. P. Felt; A Valuable Aid in the Control of the Feather Mite, *Liponyssus sylviarum*, by C. R. Cutright; A Disease Differing from Wilt Observed in Gipsy

[3] Biol. Soc. Wash. Proc., 39 (1926), pp. 75–103.

Moth Larvae, by D. F. Barnes and S. F. Potts; A Tarsonemid Mite Attacking Narcissus, by C. F. Doucette; and Preliminary Report on Control of Hibernating Codling Moth Larvae, by L. C. McAllister, jr.

Twenty-eighth report of the State entomologist of Connecticut, 1928, W. E. Britton (*Connecticut State Sta. Bul. 305 (1929), pp. 665–768, pls. 16, figs. 9*).—The first part of this report (E. S. R., 59, p. 455) deals with the entomological features of 1928, including fruit, vegetable, and shade and forest tree insects, those infesting ornamental shrubs and vines, attacking flowers and greenhouse plants, and injuring stored vegetable products. This is followed by accounts of the inspection of nurseries in 1928 (pp. 689–700), and inspection of imported nursery stock (pp. 701–703), both by Britton and M. P. Zappe; inspection of apiaries in 1928 (pp. 703–712); and gipsy moth work in Connecticut in 1928, by Britton and J. T. Ashworth (pp. 712–728).

Then follow Notes on Fruit Insects in 1928, by Zappe (pp. 728, 729); accounts of Plant Bug [*Lygus quercalbae* Knight, *L. omnivagus* Knight] Injury to Fruits (pp. 729–731), and The Oriental Peach Moth (pp. 731–734), both by P. Garman, and of Corn Borer Clean-up Operations on the 1927 Infestations, by Zappe (pp. 734–737); a Report of Scouting and Quarantine Enforcement for the Japanese Beetle and Asiatic Beetle, by J. P. Johnson (pp. 737–744); a discussion of The Periodical Cicada or Seventeen-Year Locust in 1928, *Tibicina septendecim* Linn. (pp. 744–751); Notes on the Nest Building Habits of the Pipe Organ Wasp [*Trypoxylon albitarse* Fab.], by T. B. Osborne (pp. 751–753); a report on Mosquito Control Work in Connecticut in 1928, by R. C. Botsford (pp. 753–761); and Miscellaneous Insect Notes (pp. 762–766).

[Economic insects and their control in Illinois] (*Ill. State Hort. Soc. Trans., 62 (1928), pp. 97–109, 111–122*).—Accounts are given on Orchard Insect Control for 1928, by W. P. Flint (pp. 97–109), and The Oriental Fruit Moth, by L. A. Stearns (pp. 111–122), and Notes on the 1928 Distribution and Infestation of the Oriental Fruit Moth in Illinois, by W. P. Flint (p. 122).

Insect and other invertebrate pests in 1927, R. S. MacDougall (*Highland and Agr. Soc. Scot. Trans., 5. ser., 40 (1928), pp. 116–145, figs. 16*).—This is the author's usual annual summary of the more important insects and related pests met with in Scotland during the year (E. S. R., 58, p. 527).

[Report of the director of the entomological station and of the director of the plant pathological station of Paris for the years 1926 and 1927] (*Min. Agr. [France], Ann. Épiphyties, 13 (1927), No. 6, pp. 383–515*).—The first part of this report (pp. 383–454) deals with administrative measures employed in the protection of cultivated plants and the organization of control work against their enemies, including insects and other animal pests of cultivated plants, the nonparasitic diseases, and the diseases caused by vegetable parasites. This is followed by summarized reports on work accomplished in the laboratories in 1926 and 1927 at the Central Entomological Station, Paris, reported upon by P. Marchal (pp. 455–460); the Entomological Station, Bordeaux, by J. Feytaud (pp. 460–463); the Entomological Station, Saint-Genis-Laval, by A. Paillot (pp. 463–468); the Entomological Station, Rouen, by R. Regnier (pp. 469–475); the Menton Insectary, annex of the Entomological Station, Paris, by R. Poutiers (pp. 475–478); the Zoological Station relating to Useful and Injurious Vertebrates, by A. Chappellier (pp. 478–482); the Entomological Station, Chalette Montargis, annex of the station at Paris, by L. Gaumont (pp. 482–484); the Central Plant Pathological Station, Paris, by Foex (pp. 484–491); the Agronomic Station, Avignon, by Joessel (pp. 491, 492); etc.

The agricultural pests of Denmark, S. Rostrup and M. Thomsen (*Vort Landbrugs Skadedyr. Copenhagen: August Bangs, 1928, 4 ed., rev. and enl., pp.*

XIX+348, figs. 224; rev. in Ann. Appl. Biol., 15 (1928), No. 3, p. 514).—This is a revised and enlarged edition of a practical work, the third edition of which appeared in 1907. It deals with the insect and some other invertebrate pests of crops in Denmark, and means for their control. The work is based upon field observations and experimental work. A key for the identification of the more important pests and a bibliography of 11 pages are included.

Animal enemies of tobacco [trans. title], A. Buonocore (*Bol. Tec. [R. Ist. Sper. Coltiv. Tabacchi, Scafati], 22 (1925), Nos. 1, pp. 9–18; 2, pp. 43–56; 3, pp. 107–121; 4, pp. 189–203; 23 (1926), Nos. 1, pp. 3–27; 2, pp. 55–82, pls. 7; 3, pp. 119–129; 4, pp. 181–193; 24 (1927), Nos. 1, pp. 17–25, pls. 2; 2, pp. 75–82; 3, pp. 123–136, pls. 2; 4, pp. 205–215; 25 (1928), Nos. 1, pp. 3–18; 2, pp. 83–102, pls. 4; 3, pp. 133–149; 4, pp. 218–220*).—This is a continued account of the insect, mammalian, avian, and other enemies of tobacco.

The need for investigations on shade tree insects, E. P. Felt (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 417–420*).—The need for further work on shade tree insects is pointed out.

Notes on insects inhabiting the roots of weeds, H. L. Sweetman (*Ann. Ent. Soc. Amer., 21 (1928), No. 4, pp. 594–600*).—This contribution from the Wyoming Experiment Station lists insects inhabiting the roots of weeds, by order and family, and gives a host list.

A handbook of the dragonflies of North America, J. G. Needham and H. B. Heywood (*Springfield, Ill.: Charles C. Thomas, 1929, pp. VIII+378, figs. [136]*).—The first part of this handbook consists of a general account of dragon flies (pp. 3–47). The second or systematic part (pp. 49–358) presents keys to the genera and species and descriptions of 360 forms, representing 75 genera. A bibliography of 7 pages is included.

Investigations into the locust plague in Cyprus, C. G. Pelaghias (*Cyprus Agr. Jour., 24 (1929), Nos. 1, pp. 10–20; 2, pp. 54–62*).—A discussion of the locust problem in Cyprus.

The role of Bordeaux mixture as a leafhopper insecticide, D. M. DeLong (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 345–353, pl. 1*).—"Experiments in the control of the potato leafhopper, *Empoasca fabae* Harris, on both potato and bean show that treatments with pyrethrum extracts have an immediate action upon the leafhoppers but do not affect the individuals which hatch a few hours after treatment. The leafhoppers which fed upon plants treated with Bordeaux mixture did not show any decrease in numbers for the first 24-hour period, but after the lapse of this time there was a gradual decline in the insect population until none remained alive after 3 or 4 days. The nymphs hatching after treatment were also killed. Leafhoppers which were thoroughly wetted with Bordeaux mixture were not affected. Experiments of the several types conducted indicate that the copper from the Bordeaux mixture is absorbed by the plant, and demonstrate that Bordeaux mixture has a direct insecticidal action upon leafhoppers."

Biology and natural control of the green citrus aphid Aphis spiraecola Patch, R. L. Miller (*Fla. Ent., 12 (1928), No. 4, pp. 49–56, figs. 7*).—This is a summary of work with *A. spiraecola* conducted over a period of two years at the Citrus Experiment Station at Lake Alfred, Fla. The seasonal appearance of the pest is shown in chart form.

In a study of its natural enemies 10,000 aphids were counted each week, and all the natural enemies of this number were recorded. The efficiency of each of the several predatory enemies as indicated by the number of aphids destroyed daily was determined by life history and feeding records. The average number of citrus aphids destroyed daily by its more important natural enemies was as

follows: *Hippodamia convergens* 61, *Syrphus wiedemanni* 45, *Baccha lugens* 35, *Allograpta obliqua* 34, *B. clavata* 33, *Chrysopa* sp. 28, *Cycloneda sanguinea* 26, *Coccinella oculata* 21, *Scymnus* sp. 20, *Hemerobius* sp. 20, and *Leucopis americana* 17. The results of the work of predators are shown by means of charts.

The woolly apple aphis (Eriosoma lanigerum Hausmann) in Chosen, S. NAKAYAMA, T. TANAKA, and S. MARUTA (*Chosen Govt. Gen. Agr. Expt. Sta. Bul. 4 (1928), pp. [3]+21, pls. 8, figs. 4*).—This is an account of the life history, bionomics, economic importance, natural enemies, and control measures for the woolly apple aphid. A list of 39 references to the literature is included. The paper summarizes the more important facts noted by the authors during the past 3 years at the experiment station at Suigen.

On the occurrence of the parthenogenetic and sexual forms in Aphis rumicis L., with special reference to the influence of environmental factors, J. DAVIDSON (*Ann. Appl. Biol., 16 (1929), No. 1, pp. 104–134, pl. 1, figs. 5*).—This subject is presented under the headings of methods of rearing the various parthenogenetic lines, normal occurrence of the parthenogenetic and sexual forms, normal occurrence of parthenogenetic alatae and apterae, the fundatrigeniae, the alienicolae generations, and general conclusions and summary.

Ten related lines of *A. rumicis* were reared in which parthenogenetic individuals were obtained in successive generations extending over varying periods, the longest having been 2 years 10 months, in which 50 generations were passed through.

Tuba root (Derris elliptica) as a remedy against the tobacco aphid (Myzus persicae) in Deli [trans. title] (*Meded. Deli Proefsta. Medan, 2. ser., No. 58 [1928], pp. 61, pls. 2; Eng. abs., pp. 54–58*).—This is a report of work conducted on the insecticidal properties of Derris as a means of control of the green peach aphid, presented in connection with a review of the literature consisting of 51 titles relating to its botany, cultivation, and the chemistry of the plant. Following an introduction, by J. Kuijper, chapters are given consisting of Botanical Description and Culture of Tuba, by S. C. J. Jochems; The Manufacture of Tuba Root Extract, by M. de Groot; Control of the Poisonous Properties of Tuba Root Extract by the Biological Method, by J. C. van der M. Mohr; The Effect of Tuba on the Tobacco Aphid (*M. persicae*), also in Comparison with that of Nicotine, by J. K. de Jong; The Effect of Tuba on Caterpillars, by J. C. van der M. Mohr; and A Review of the Chemical Investigations, by P. A. Rowaan.

Variation in resistance of aphids to toxic sprays, N. TURNER (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 323–326*).—The differences in resistance of aphids to a toxic spray are pointed out. Attention is called to a simple method of applying contact insecticides, the results of sprays applied with this method being reported upon.

The peach aphid (Myzus persicae Sulz.) as an agent in virus transmission, I. A. HOGGAN (*Phytopathology, 19 (1929), No. 2, pp. 109–123, pls. 2, fig. 1*).—This is a report of work conducted by the Wisconsin Experiment Station in cooperation with the U. S. D. A. Bureau of Plant Industry. The investigations conducted, the details of which are presented in considerable part in tabular form, have demonstrated that the green peach aphid readily transmits the cucumber mosaic virus between tobacco and certain other susceptible solanaceous host plants. As compared with methods of artificial inoculation, the green peach aphid behaves as a highly efficient agent in the transmission of this virus. Comparative trials, carried out under identical condi-

tions, gave no evidence of transmission of the tobacco mosaic virus by the same aphid between the same host species.

The peach aphid exhibits a definite selectivity in virus transmission, colonies reared upon tobacco plants, infected with both cucumber and tobacco mosaic, transmitting only the cucumber mosaic virus from the combination, although the tobacco mosaic virus is present in the leaves upon which the aphids have fed. This selectivity in virus transmission suggests that the relation between aphid and virus may not be purely mechanical.

It is not believed that the green peach aphid is responsible for the dissemination of ordinary tobacco mosaic in the field.

The evolution of cycles and the origin of heteroecy (migrations) in plant-lice, A. Mordvilko (*Ann. and Mag. Nat. Hist., 10. ser., 2 (1928), No. 12, pp. 570–582*).—A general discussion of the subject.

Results of the eighth year's work against the gipsy moth in New Jersey, H. B. Weiss (*N. J. Dept. Agr. Circ. 150 (1928), pp. 10, figs. 2*).—This is a summary of control and elimination work with the gipsy moth in New Jersey during the year ended June 30, 1928 (E. S. R., 58, p. 559).

A new beneficial moth from Panama and a scavenger (Lepidoptera, Pyralidae, Phycitinae), H. G. Dyar (*Ent. Soc. Wash. Proc., 31 (1929), No. 1, pp. 16, 17*).—Under the name *Vitula saissetiae* n. sp. the author describes a small moth the larvae of which feed upon the scale Saissetia. The larvae of this moth form a fine web over the scales in which they live.

A new injurious pine moth (Lepidoptera: Gelechiidae), A. Busck (*Ent. Soc. Wash. Proc., 31 (1929), No. 1, pp. 13–15, fig. 1*).—Under the name *Recurvaria condignella* n. sp. the author describes as new to science a species which was reared from yellow pine in Florida and in Arizona where it was abundant in the tips of western pine trees of sapling size.

A summary of the investigations of the sugar cane moth stalkborer in Cuba, H. K. Plank (*Trop. Plant Research Found. [Wash., D. C.] Bul. 8 (1929), pp. 16, figs. 5*).—This is a summary of work conducted with the sugarcane borer in Cuba, presented in connection with a list of 14 references to the literature. The loss caused by this pest to the sugar industry is said to have increased until at the present time it amounts to over 13 per cent of the total crop, and in individual instances to much more.

Fruit-piercing moths, D. Gunn (*Farming in So. Africa, 3 (1929), No. 35, pp. 1263, 1264*).—This is an account of three species of fruit-piercing moths, namely, *Achaea lienardi*, *Serrodes partita*, and *Sphingomorpha chlorea*, said to be common in the eastern Cape Province.

The velvet bean caterpillar, a peanut pest in the Everglades (*Fla. Ent., 12 (1928), No. 3, pp. 39, 40*).—Reference is made to an attack by *Anticarsia gemmatilis* on peanuts grown on large plantations in the Everglades.

Contribution to the morphology and biology of the lilac tineid Gracilaria syringella Fab. [trans. title], R. Pussard (*Min. Agr. [France], Ann. Épiphyties, 14 (1928), No. 2, pp. 107–131, figs. 8*).—This is an account of a cosmopolitan insect which is a frequent source of injury to lilacs and privets in France, where three generations occur from May to October. The house sparrow and the European earwig are said to have been important predatory enemies of the caterpillar in the rolled leaves at Rouen in 1925.

A list of 35 references to the literature is included.

Spraying experiments for codling moth control, A. Spuler (*Washington Col. Sta. Bul. 232 (1929), pp. 70, figs. 9*).—A detailed report of spraying work for the control of the codling moth, much of the data being presented in tabular form.

None of the spray treatments discussed proved to be 100 per cent effective. The degree of control obtained by various treatments depends largely on the number of worms that must be destroyed in order to protect the fruit, and it is pointed out that even though a given spray material may prove to be 90 per cent effective in killing the worms or eggs of the codling moth, the 10 per cent that survive the treatment may in severely infested orchards produce considerable injury to fruit, although in orchards having a light infestation this injury would be insignificant.

The results of the investigations at Wenatchee showed that some combinations of mineral oil and lead arsenate, of fish oil and lead arsenate, and of mineral oil and nicotine sulfate are even more effective than lead arsenate alone. Their use in a spray program is limited, however, since the mineral oil sprays in combination with either lead arsenate or nicotine sulfate when applied in more than two or three applications are likely to produce injury to fruit. Furthermore, the combinations of mineral or fish oil with standard strength of lead arsenate is likely to complicate the problem of spray residue removal. The combinations of mineral or fish oil with standard strength of lead arsenate should therefore be used only where the degree of infestation warrants the use of a more effective spray than the standard lead arsenate and then only in a limited way as pointed out previously. Where other insects such as red spider and aphid are present in the orchard, one or two applications of oil and nicotine sulfate can be used to advantage. This combination should be substituted for a corresponding number of the lead arsenate cover sprays.

While it was found that lead arsenate used at the rate of 4 lbs. to 100 gal. is more effective in protecting fruit from worm injury than when used in concentrations of 2 lbs. to 100 gal., this difference is not sufficient in orchards of light to normal infestation to warrant the use of the heavier concentration. Casein lime spreaders have not increased the insecticidal value of lead arsenate. Fish oil, a semidrying oil, when added to lead arsenate caused the arsenical to adhere better to fruit and foliage, and to give increased protection to fruit. Lead arsenate 1–100 and fish oil 0.25 per cent gave as good results as twice that amount of lead arsenate used alone. The results of tests with spreaders and stickers indicate that materials added to lead arsenate to increase its adhering or sticking properties increase its insecticidal value, and conversely that materials added to lead arsenate to facilitate removal reduce its insecticidal value.

Magnesium, calcium, aluminum, and manganese arsenates did not give results equal to those from lead arsenate, and burning to fruit and foliage resulted where calcium and manganese arsenates were used. Sodium and barium fluosilicates, even when combined with fish oil, proved inferior to lead arsenate.

Oil sprays act as ovicides and to some extent as larvicides, but when used alone failed to control the codling moth. In experiments at Wenatchee, repeated applications of oil sprays, especially those of high viscosity, resulted in injury to fruit and foliage. These results indicate that oils should not be applied more than two or possibly three times during the season. Nicotine sulfate acts as an ovicide and larvicide, but soon loses its insecticidal value, and can not be used alone unless applied at frequent intervals.

One lb. of aluminum sulfate added to 100 gal. of spray liquid containing nicotine sulfate 1–800 prolonged its insecticidal value. This spray produced a russeting or blotching of fruit, which in some cases was so pronounced as to lower the grade of the fruit. Nicotine oleate was not as effective as nicotine sulfate.

Oil sprays were effective when combined with such insecticides as lead arsenate and nicotine sulfate. The combination of oil and nicotine resulted in a very effective spray treatment. In four tests of this combination, this spray

was equal to or better than the standard lead arsenate spray for codling moth. Since this spray also is very effective in controlling other pests, as red spider, leafhopper, and aphid, it may be used as a substitute for some of the lead arsenate sprays in that part of the spray program where it will be most effective in controlling all of the pests concerned. Because of the high cost and possibility of injury from this spray, the number of spray applications should be limited to two or possibly three.

Mineral oil combined with lead arsenate forms a very efficient spray. In one test, a combination spray of oil and lead arsenate at 0.5 lb. to 100 gal. of water was equivalent in insecticidal value to four times that amount of lead arsenate used alone. Oil also acts as a sticker for lead arsenate and thus makes the arsenical more effective. This combination results in the deposit of a larger amount of arsenical residue on the fruit and in increased difficulty in spray residue removal. The combination of light oil and lead arsenate in 1928 did not give good results, probably because the oil caused the lead arsenate particles of the particular brand of lead arsenate used to flocculate and settle to the bottom. Small amounts of oil added to the spray did not produce this effect. Nicotine sulfate did not increase the efficiency of lead arsenate sprays, and a combination of standard lead arsenate spray with nicotine sulfate 1–800 gave results similar to the lead arsenate used alone. An alcohol extract of pyrethrum when used in combination with lead arsenate improved the efficiency of lead arsenate.

Manganese arsenate as a control for the codling moth, R. L. Miller (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 340–345, pls. 2*).—"Manganese arsenate when used in the laboratory alone or with lime was not quite as effective in preventing the entrance of newly hatched codling moth larvae into carefully sprayed apples as was arsenate of lead. When mixed with lime sulfur or lime and lime sulfur there was little difference in the effectiveness of the two materials. The addition of lime, lime sulfur, or both, decreased the efficiency of both manganese arsenate and lead arsenate. In the field experiments manganese arsenate gave as good or better results when mixed with lime sulfur as did arsenate of lead. Arsenate of lead was slightly better than manganese arsenate when each was used alone. The residue of manganese arsenate was more easily removed than was that of arsenate of lead."

Experiments with talc and other dusts used against recently hatched larvae of the oriental and codling moths, B. F. Driggers (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 327–334*).—A report of experiments conducted at the New Jersey Experiment Stations.

"Preliminary laboratory tests with coarsely ground automobile tire mica dusted on peach foliage showed that a high percentage of newly hatched larvae of the oriental peach moth were killed before they reached a point of entry. More extensive laboratory tests with a number of dusts showed that finely ground talc and mica killed a high percentage of oriental peach moth larvae hatching from eggs on peach foliage dusted with these materials. Limited field tests with talc and mica showed that talc sticks better and is more effective than mica or hydrated lime in reducing larval entry into peach twigs.

"Limited tests with talc and mica dusted on foliage containing codling moth eggs showed that the young larvae of this insect are killed by both materials."

European corn borer in Pennsylvania, T. L. Guyton and P. G. Brown (*Penn. Dept. Agr. Bul. 469 (1928), pp. 11, figs. 5*).—A practical summary of information on this insect and means for its control.

Report of conference on research investigations of the European corn borer, Washington, D. C., January 6 and 7, 1927 (*[U. S. Dept. Agr., Bur. Ent.], 1927, pp. 8*).—This is a mimeographed report of the conference

Complete research program, European corn borer, 1928 (*U. S. Dept. Agr., Bur. Ent., 1928, pp. IV+71, figs. 2*).—This report in mimeographed form of the research program includes the second conference, the first of which is noted above.

Complete research program, European corn borer, 1929 (*U. S. Dept. Agr., Bur. Ent., 1929, pp. [2]+51*).—This is a report in mimeographed form on the complete research program, including the report of the joint committees of the American Association of Economic Entomologists, the American Society of Agronomy, the American Society of Agricultural Engineers, and the American Farm Economic Association.

Report of the third annual conference on European corn borer research, Washington, D. C., January 2, 1929 (*U. S. Dept. Agr., Bur. Ent., 1929, pp. III+23*).—This is a mimeographed report of the third annual conference (see above).

Airplane dusting experiment and results secured for the control of the pecan leaf case-bearer, G. F. Moznette (*Natl. Pecan Exch. News, 6 (1929), No. 1-2, pp. 5-13, figs. 2*).—In work conducted by the U. S. D. A. Bureau of Entomology during the two seasons preceding, it was found that fairly good results could be secured in the control of *Acrobasis palliolella* Rag. by dusting with ground machines. In preliminary test flights at Tallulah, La., in April, 1928, in which applications of a dust consisting of 20 per cent of monohydrated copper sulfate, 10 per cent of lead arsenate, and 70 per cent of hydrated lime were made by airplanes furnished by the Delta laboratory of the bureau, the test showed that lead arsenate is distributed quite evenly to all portions of the dust cloud and makes a fairly good dusting material.

In dusting work carried on in cooperation with the U. S. D. A. Bureau of Plant Industry, five applications were made during the summer and early fall. The first three were made with the regular pecan scab dust consisting of 20 per cent of monohydrated copper sulfate and 80 per cent of hydrated lime. The last two dustings of the grove for the pecan leaf case-bearer and pecan scab consisted of the combination dust employed in the preliminary test. The applications were made in a grove of about 26 acres, consisting of 520 trees, situated at Putney, Ga. The first dust of 76 lbs. per acre was applied in the early morning of July 25, it taking 1 hour 27 minutes. The second dust was applied in 1 hour 25 minutes on August 8 to the same trees, each dusting consisting of 4 loads with a total of 2,000 lbs. of dust, or 76 lbs. per acre and 3.8 lbs. per tree. The details of examinations and sampling to determine the percentage of infested buds and the number and percentage of hibernacula formed on the buds in the various areas are reported in tabular form.

It is pointed out that in dusting pecan trees 30 ft. in height with a dust containing 10 per cent of lead arsenate even when applied at the rate of 76 lbs. per acre there is apparently too great a dispersion of the dust cloud to secure effective control against an insect like the pecan leaf case-bearer. This might be overcome by increasing the percentage of lead arsenate in the dust mixture.

The airplane duster used in the experiment was especially designed for light dosages, as in dusting cotton. Further investigational work is considered necessary in the construction of equipment adequate to deliver greater dosages, such as are required in dusting trees the size of pecans.

Use of arsenical preparations in the control of anopheline larvae [trans. title], **O. D. Tichenko** (*Bul. Soc. Path. Exot., 21 (1928), No. 8, pp. 655, 656*).—The author's experiments have shown that under natural conditions sodium arsenate, which is readily soluble, is satisfactory in the destruction of anopheline larvae in shallow bodies of standing water. The experiments with arsenicals

demonstrated that the minimal doses lethal for anopheline larvae do not injuriously affect fish. The destruction of larvae was complete in 24 hours after the application of copper arsenate and in 48 hours after the application of iron arsenate.

Studies on malaria, R. Ross (*London: John Murray, 1928, pp. XI+196, pls. 4*).—This is a summarized account of the work conducted by the author, in which he first demonstrated the rôle of Anopheles mosquitoes in the transmission of the malarial parasites.

Studies on Oscinella frit Linn., N. Cunliffe (*Ann. Appl. Biol., 16 (1929), No. 1, pp. 135–170, figs. 8*).—This report of further studies of the frit fly (E. S. R., 58, p. 459; 60, p. 850) deals with certain oat varieties in relation to their resistance to attack by this pest in Sweden, together with data concerning the production of resistant utility varieties.

The status of the onion maggot (Hylemyia antiqua Meig.) in Wisconsin, H. F. Wilson and W. Whitcomb, Jr. (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 400–405*).—Observations on the seasonal life history of this pest, extent of damage, etc.

The carrot rust fly problem in New York, H. Glasgow and J. G. Gaines (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 412–416, fig. 1*).—An account of the life history and control of this pest in New York, where in some of the important carrot-growing sections it is a serious menace to the production of the crop.

Notes on the potato scab-gnat, Pnyxia scabiei (Hop.), H. L. Gui (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 397–399*).—This contribution from the Ohio Experiment Station is based upon observations made since 1926. An earlier account of this pest has been noted (E. S. R., 57, p. 162).

***A contribution to the study of control measures for cucumber beetles*, Diabrotica duodecimpunctata Oliv. and vittata Fabr.**, H. C. Huckett (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 405–411*).—The author has found in the use of nicotine dusts for cucumber beetles under controlled conditions that their effectiveness is dependent upon relatively dry environmental conditions, direct contact of dust with beetle, and heavy applications. Under these conditions it was also found that many arsenical and nonarsenical hydrated lime dust mixtures as well as pure hydrated lime are noticeably effective as insecticides.

Control measures for cucumber beetles, H. C. Huckett (*New York State Sta. Tech. Bul. 148 (1929), pp. 82*).—Studies of control measures for the spotted cucumber beetle and the striped cucumber beetle have been carried on at Riverhead, L. I., since 1923 with a view to adapting the most promising methods to local conditions. The study has been divided into three parts, (1) dealing with the after-effect of spray and dust treatments on plant growth and yield, (2) concerning the effect of dust treatment on beetle behavior, and (3) the use of "trap" plants for the segregation of beetles and the development of means for their destruction.

In control work, in which frequent and heavy applications of spray and dust materials were applied for plant protection during seedling growth, it was found that plant development and yield were less affected by arsenical spray mixtures than by arsenical dust mixtures. After the plants had outgrown the early stages of development, the time and amount of spray mixture required in frequent and thorough applications rendered the practice of spraying of doubtful commercial value, except possibly under very favorable circumstances, such as small acreages or where a high cash value was attached to the crop.

"Under the conditions mentioned above plants were less harmfully affected by dust mixtures containing gypsum than those containing hydrated lime. The most successful results were obtained with a mixture of calcium arsenate and

gypsum in proportions by weight equivalent to 1 to 15. Plants were retarded in growth by frequent and thorough applications of Bordeaux mixture and nicotine dust made during early growth.

"In experiments in the field and insectary concerning the behavior of cucumber beetles under dusted conditions, it was found that under optimum conditions beetles were readily killed by contact with hydrated lime mixtures. On the other hand, the same mixtures had relatively little lethal value when applied to the plant food, largely on account of their repellent effect. The presence of moisture tended to render dust mixtures innocuous. In the field, foliage development was an important factor which handicapped the effective use of lethal measures. The most important factors enhancing the value of the lethal properties of dust mixtures were thorough contact with the beetles, restricted plant development, low humidity, and heavy dosage. Restricted plant growth was maintained by the use of seedlings from successive sowings in trap rows distributed among the main crop rows. These rows served as points for the segregation of beetles disturbed by treatment of the main crop.

"In order to circumvent the factor of low humidity, which is rarely obtainable on Long Island, use was made of a blow torch with effective results. It was found that the success of trap plants for the segregation of cucumber beetles was largely dependent upon the thorough and consistent treatment of the main crop before the latter had commenced to blossom. Beetles were not readily disturbed by treatment when feeding on the blossoms."

Questions and answers on the Japanese beetle, V. I. SAFRO (*N. J. Dept. Agr. Circ. 152 (1929), pp. 29, figs. 6*).—This is a summary of information on the Japanese beetle, presented in a practical form.

Some observations on Japanese beetle injury, I, II (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 317–322*).—In part 1 an account of unsprayed communities is presented by V. I. Safro (pp. 317–319), and in part 2 sprayed communities by G. F. MacLeod (pp. 320–322).

Effects of geranium on the Japanese beetle, C. H. BALLOU (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 289–293, pls. 4*).—The author finds the Japanese beetle to feed on cultivated geraniums, resulting in a paralysis beginning with the hind legs and progressing cephalad. About 35 per cent of the paralyzed beetles under observation died within 4 days, most recoveries taking place within 24 hours. The flower appears to be more attractive to the beetles and more toxic to them than the foliage, and the effect is heightened when the feeding takes place on plants exposed to sunlight. The mid-gut of beetles dying from eating geraniums is disintegrated within 24 hours, and the soft contents of the body cavity within 48 hours.

A trap for the Japanese beetle, E. A. RICHMOND (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 293–314, pls. 4, figs. 3*).—The author reports upon four years' work in trapping the Japanese beetle and describes the so-called standard trap decided upon as the most satisfactory one developed. The traps tested are briefly described and figured, and the composition of the attractive bait is given. The proportion of the sexes caught and the comparative abundance of beetles collected in different localities during the same year as well as over a period of two years are discussed. Temperature and humidity had an important bearing on the beetle collections. The efficiency of the standard trap is considered, and modifications which improve its catch are described. Although the trap is practically specific for the adult Japanese beetle, other species which were caught are mentioned. The use of traps as a possible protection for orchards and their value in investigating the abundance of beetles are dealt with.

The Asiatic beetle in Connecticut, R. B. FRIEND (*Connecticut State Sta. Bul. 304 (1929), pp. 581–664, pls. 4, figs. 24*).—This is an extended account of

studies of the anatomy and biology of *Anomala orientalis* Waterh., which was first discovered in Connecticut in 1920 and has since been found in parts of New York and New Jersey. At New Haven the great majority of the individuals of this species were found to go through a complete life cycle in one year, although a few require two years for the completion of their development.

"The adults emerge from the pupal stage late in June and during July and August and oviposit in the soil at a depth of about 6 in. The eggs hatch in 3 to 4 weeks, and the young larvae move up close to the surface of the soil where they feed on grass roots and decayed organic matter. In September and October the lawns in heavily infested areas are severely injured and the grass in spots completely killed. Late in October and during November the larvae descend into the soil to a depth of about 1 ft. to hibernate, most of them being at this time in the third larval instar. The last of April the larvae come up close to the surface and resume feeding, and the first of June they go down again to a depth of about 6 in. to pupate. After a prepupal period of about 6 days they molt and the pupal stage begins. This lasts about 2 weeks.

"There is at present no effective natural control of this insect in New Haven, and reliance must be placed on insecticides. Lead arsenate and carbon bisulfide have given good control in lawns where properly applied. The latter is used in the form of an emulsion containing 70 per cent CS_2 diluted 200 times with water and applied at the rate of 3 pints of diluted material per square foot of surface. This insecticide is effective for a short time only, however, and lead arsenate gives a more permanent control. This may be applied to the surface of the lawn at the rate of 2 lbs. per 100 sq. ft. of surface and worked into the soil to a depth of 1 in. It may be used in a top-dressing of loam at the same rate, or it may be applied as a suspension in water at the rate of 3 lbs. per 100 sq. ft. of surface."

A list is given of 70 references to the literature.

Known distribution and abundance of Anomala orientalis Waterhouse, Aserica castanea Arrow, and Serica similis Lewis in New York, H. C. Hallock (*Jour. Econ. Ent., 22 (1929), No. 2, pp. 293–299, figs. 4*).—In addition to the records relating to the distribution of these beetles, notes are given on their general abundance where they have been found to occur in New York State.

Resumption of egg-laying by hibernated cotton boll weevils (Anthonomus grandis Boh.), E. F. Grossman (*Fla. Ent., 12 (1928), No. 3, pp. 33–38*).—Earlier work having indicated that the boll weevil must feed on squares before it can lay eggs, the author was led to conduct the further experiments at the Florida Experiment Station here reported. In two instances eggs were laid within 24 hours following a leaf diet. He concludes that if the presence of a vitamin is necessary for the oviposition of eggs it must be present in the terminal leaves as well as in the squares.

Boll weevil control by airplane dusting, F. L. Thomas, W. L. Owen, jr., J. C. Gaines, jr., and F. Sherman iii (*Texas Sta. Bul. 394 (1929), pp. 40, figs. 11*).—This is a report upon airplane control work conducted on farms near Wharton, Navasota, and College Station. The cotton acreage in Texas protected against insects by airplane dusting has increased from 3,000 acres in 1925 to approximately 50,000 acres in 1928. The observations on the three farms, which grew, respectively, 400, 1,200, and 2,700 acres of cotton, were made in connection with the operations of three airplane corporations.

Increased yields varying from 63 to 206 lbs. of seed cotton per acre were produced in all cases where conditions warranted the use of control measures. From 3 to 5 applications of calcium arsenate dust were made. The amount

applied per acre per application was about as specified by the owners of the farms, and in one case was nearly 8.5 lbs. In each instance the amount exceeded 5 lbs., or the usual recommendation for a per acre application. The number of squares punctured by boll weevils was reduced 50 per cent 10 days after dusting started and after two applications had been made. Good profits as a result of boll weevil control were made on the two largest farms, and a much better profit than was obtained should have resulted from work on the smallest farm.

It is pointed out that in airplane dusting for boll weevil control it is especially important that information be obtained on the condition of the infestation at the beginning of dusting operations. For best results, it is also important that applications be made at 5-day intervals. The cost of airplane dusting, including the poison, ranges from $0.75 to $1 per acre per application. This method of applying dust should prove profitable for the cotton growers as well as the corporations where the infestation averages 15 per cent early in the season or 20 per cent later in the season, with weather conditions favoring increase in weevil injury.

Airplane dusting offers relief in those cases where, owing to wet grounds, teams and men can not get into the fields at the proper time to maintain the necessary 5-day intervals of application. Dusting is profitable if the infestation is thereby kept down or reduced when it would otherwise be high, provided, of course, the soil is rich enough to produce a good crop in the absence of weevil damage. Furthermore, the price of cotton must be high enough to justify the expense of dusting. As a rule small detached areas can not be dusted by airplane as profitably as large areas.

Studies of the biology of Swedish bark beetles with particular consideration of the generation question, I [trans. title], P. Spessivtseff (*Meddel. Statens Skogsförsöksanst.* [*Sweden*], *No. 24* (*1927–28*), *pp. 221–250, figs. 16; Ger. abs., pp. 244–250*).—This first part deals with the beetles *Hylurgops glabratus* Zett., *Carphoborus cholodkovskyi* Spess., *Dryocoetes autographus* Ratz., and *D. hectographus* Reitt.

Practical bee-breeding, A. Gilman (*London and New York: G. P. Putnam's Sons, 1928, pp. 248, figs. 21*).—The several chapters of this work deal, respectively, with the hive; some races of the honeybee; desirable characteristics in the honeybee; raising queens from eggs or larvae; queen rearing; the control of mating; mating nuclei; the group system; marking and clipping queens—caging queen and escort, etc.; queen introduction; the breeding influence of the male; making a strain; and pedigree or line breeding.

Ants and their relation to aphids, C. R. Jones (*Colorado Sta. Bul. 341* (*1929*), *pp. 96*).—This report of studies of ants and their relation to aphids includes (1) records of definite aphids on one host plant with the number of different ant attendants, (2) records of the same ant attending the same aphid on different host plants, (3) a list of Colorado ants and records of aphids attended (pp. 30–56), (4) a list of Colorado ants with the number of genera and species of aphids they attended, (5) a list of aphids with ant attendants (6) an aphid list with number of genera and species of ant attendants, (7) a list of ants associating together in aphid colonies, and (8) a list of mixed ants with genera and species associating together in aphid colonies. A bibliography of 385 references to the literature is also included.

Biological studies on *Poecilogonalos thwaitesii* (Westw.), parasitic in the cocoons of *Henicospilus* (Hymen.: Trigonalidae), C. P. Clausen (*Ent. Soc. Wash. Proc., 31* (*1929*), *No. 4, pp. 67–79, fig. 1*).—An account of the life history of this parasite, including a technical description of its several stages and notes on its control.

ANIMAL PRODUCTION

The comparative values of sorghum silage and fresh guinea grass, I, II (*Jour. Cent. Bur. Anim. Husb. and Dairying, India, 2 (1928), Nos. 1, pp. 31–34, pl. 1; 3, pp. 123–129*).—A comparison of sorghum silage and guinea grass as roughages for calves was made by the Imperial Department of Agriculture, India.

I. *Food consumption and live weight increase*, F. J. Warth and M. P. K. Kutty.—Two lots of calves were fed a mixture of 2 parts of wheat bran and 1 part of peanut cake at the rate of 5 kg. per 100 lbs. of live weight. In addition one lot received all the silage it would consume and the other lot all the fresh cut guinea grass it would eat. During the 16 weeks of the experiment the calves in the silage group gained an average of 104 lbs. per head and those in the guinea grass group 91 lbs. per head. While the differences in gains were not considered significant, the results indicated that sorghum silage and fresh guinea grass of average quality are approximately equal for producing growth. No differences in palatability of the two feeds were observed.

II. *Digestion experiments*, F. J. Warth.—The digestibility of the two feeds was determined in further studies, two trials being conducted with each group. The average digestibility of dry matter for the silage group was 62.8 per cent and for the guinea grass group 59.16 per cent. The average digestibility of carbohydrates was 63.4 and 58.74 per cent, respectively, for the two groups. The difference in the digestibility of dry matter and carbohydrates was readily explained on the basis of the digestibility of crude fiber, which averaged 58.71 and 46.81 per cent, respectively. In the case of nitrogen digestion the guinea grass ration was superior to the silage ration. The average percentage for the digestion of nitrogen was 74.23 in the silage group and 79.28 in the guinea grass group.

Report on inspection of commercial feeding stuffs, 1928, E. M. Bailey et al. (*Connecticut State Sta. Bul. 303 (1929), pp. 473–578+XIX*).—This is the usual report of the guaranteed and found analyses, covering 779 samples of feeding stuffs collected for official inspection during the period from September 1 to December 31, 1927, and for the year 1928 (E. S. R., 58, p. 63).

Inspection of feeds, W. L. Adams and J. E. Blaney (*Rhode Island Sta. Ann. Feed Circ., 1929, pp. 12*).—The guaranteed and found analyses for protein and fat are presented for 212 samples of feeding stuffs collected for official inspection in 1928 (E. S. R., 60, p. 253).

The utilization of browse forage as summer range for cattle in southwestern Utah, C. L. Forsling and E. V. Storm (*U. S. Dept. Agr. Circ. 62 (1929), pp. 30, pls. 6, figs. 7*).—A study to determine the best means of obtaining a reasonably full use of browse vegetation by cattle was conducted on the east slope of the Pine Valley Mountains in the Dixie National Forest in southwestern Utah during the grazing seasons of 1922 to 1925, inclusive. Records were kept of the vegetation present at the start of the experiment, the degree of utilization, and the effect of grazing on the different forage groups and the effect on the cattle grazed.

The results of the study indicate that browse range must be more conservatively used than is the common practice in order to get the best results from it. The grazing capacity of such ranges should be based on the amount of better forage that is available, allowing for the utilization of some of the less palatable shrubs. It was found that in order to perpetuate the better browse plants, from 10 to 20 per cent of each year's growth should be allowed to remain. Browse range was found to be better adapted to late spring and fall grazing than to full season grazing.

In the management of the cattle it was found that good winter care was necessary for animals that are on browse range for the entire grazing season. Cows kept under such grazing conditions must be maintained in a thrifty condition during the winter in order to make the best use of the early range feed and also that they may be in proper condition to breed again. The calves and mature dry cows were the only classes of cattle on the browse range that compared favorably in weight with similar cattle on western ranges.

Summer rations for fattening steers, R. R. SNAPP and J. H. KNOX (*Illinois Sta. Bul. 328 (1929), pp. 241–255, figs. 3*).—Concluding this study (E. S. R., 54, p. 359) of summer rations for fattening mature steers, it was found that each acre of pasture saved approximately 1 ton of alfalfa hay, but required an additional 10 bu. of corn when the dry-lot cattle were fed corn and alfalfa hay. When corn silage and cottonseed meal were fed to the dry-lot animals each acre of pasture saved approximately 500 lbs. of cottonseed meal and 2.25 tons of silage, bnt required about 18 bu. more corn. Pasture feeding required approximately 10 per cent more concentrates per unit of gain than did dry-lot feeding, but pork and manure credits were in favor of the pasture steers.

Sweetclover pasture proved an excellent forage from the latter part of June to the first of August, but during the spring it had a very laxative effect on the cattle, and during the late summer and fall was woody and unpalatable. Steers fed corn silage in dry lot made greater gains and attained a higher finish than those fed alfalfa hay, but there was no significant difference in the economy of gains of these lots.

Linseed oil meal vs. cottonseed meal for wintering beef calves, O. S. WILLHAM (*[Oklahoma] Panhandle Sta., Panhandle Bul. 7 (1929), pp. 8–11*).—The results of a preliminary test to compare the relative value of linseed meal and cottonseed meal as protein supplements for wintering beef calves are reported in this article. Two lots of 5 calves each, averaging approximately 473 lbs. per head, were fed for 90 days on a ration of ground milo and ground barley equal parts, cane fodder, and either linseed meal or cottonseed meal. The calves receiving linseed meal gained a little more rapidly and had more bloom during the latter part of the test, but their feed cost was slightly higher than in the case of the calves fed cottonseed meal.

Individual feeding for comparative feeding trials with hogs, E. W. CRAMPTON (*Macdonald Col., McGill Univ., Tech. Bul. 5 (1928), pp. 20, figs. 6*).—A study to compare group feeding and individual feeding of hogs with respect to the effects of competition at the feed trough on uniformity of gains and the effect of average v. actual data for feed consumed on the uniformity of gains per unit of feed eaten is reported in this bulletin. For the work 20 pigs weighing from 56 to 86 lbs. each were divided into 4 uniform groups and housed under similar conditions. Two lots were hand fed in troughs, and 2 lots were hand fed in individual stalls. For purposes of comparison 3 groups of data were analyzed, group 1 ordinary group feeding and assumed equal feed consumption per pig, group 2 the factor of competition eliminated and actual data on feed per pig, aud group 3 eliminating the factor of competition but assuming equal feed consnmption per pig.

From the data obtained it was concluded that for comparative feeding trials group feeding with equal feed consumption per pig assumed is not ideal. Under the above system of feeding, a large part of the differences in the gains per unit of feed consumed is due to uncontrolled factors, of which the discrepancy between actual and assumed feed consumption and the effect of competition at the feed trough are the most important. The probable error of the mean gain per unit of feed consumed can be materially reduced when indi-

vidual feed and weight records are used for analysis as compared with the assumed feed consumption now commonly used.

The results of preliminary work on bacon type, A. CALDER and A. D. BUCHANAN (*Scot. Jour. Agr., 11 (1928), No. 3, pp. 318–325, pls. 2*).—The results of preliminary work by the animal breeding research department, University of Edinburgh, Scotland, in an endeavor to improve the average quality of home-produced bacon are reported in this paper. The proposed pig-testing scheme indicates possibilities for finding differences between breeds, strains, and crossbreds as producers of suitable bacon and also as economical bacon producers.

Poultry breeding and production, I, II, E. BROWN (*London: Ernest Benn, 1929, vol. 1, pp. XV+408, pls. 68; vol. 2, pp. X+409–864, pls. 46*).—A comprehensive treatise in two volumes in which the origin, history, and distribution of domestic poultry are described, together with the breeds of fowls, ducks, geese, and turkeys. Other sections deal with the evolution and classification of breeds, laws of breeding and their application, external characters of poultry and their values, lines of development, climate and soil in relation to poultry husbandry, and the principles and practices of feeding, breeding, management, and incubation of poultry. The treatise is well illustrated, and has been written with the idea of setting forth information on the subject which has been proved by practice and obtained during the life of the author.

Artificial incubation, H. EMBLETON (*Arizona Sta. Timely Hints for Farmers, No. 160 (1929), pp. 6*).—Popular information is given on the incubation, brooding, and feeding of chicks.

The economic significance of egg weights, W. C. THOMPSON (*New Jersey Stas. Hints to Poultrymen, 17 (1929), No. 9, pp. 4*).—In this article the author points out the value of egg weights for determining the quality of eggs produced in addition to the quantity information obtained by trap nesting. The practice of weighing all eggs for two or three weeks in February is recommended as economical and profitable for obtaining an index of the performance of breeding birds, while another short-time weighing during June or July will furnish the breeder with additional information as to the value of his birds.

The preservation of eggs, E. VAN MANEN (*Union So. Africa Dept. Agr. Bul. 56 (1929), pp. 14*).—The efficiency of seven preservatives for keeping eggs was studied at the School of Agriculture, Potchefstroom, South Africa. Each lot consisted of 1 doz. white and 1 doz. brown eggs, which were tested at monthly intervals during the storage period. The tests consisted of candling and scoring for internal qualities one white and one brown egg at each period. If the eggs appeared wholesome, one was further tested by frying to study flavor and aroma and the other boiled.

Ordinary slaked lime was found useful for preserving eggs for 1 month, but for longer periods it had no value. Wheat bran and common salt were suitable for preserving eggs for eating purposes for 3 months and for cooking purposes for 5 months. Preserving eggs for periods beyond 3 months for eating and 4 months for cooking in egg wrappers was not safe. Ovoline kept eggs in good condition for both eating and cooking for a period of 5 months, but deterioration set in rapidly after this period. Water glass was superior to the other preservatives and kept eggs in wholesome condition for eating for 6 months and for cooking for 8 months. A lime and salt solution was suitable for preserving eggs for eating for a period of 5 months, after which deterioration was rapid.

There was no appreciable difference in the action of the preservatives on white and brown eggs. Moisture evaporation from the eggs was quite marked when a dry preservative was used, while liquid preservatives checked evaporation to a marked degree.

DAIRY FARMING—DAIRYING

The National Institute for Research in Dairying: Its work and needs (*Reading, Eng.: Philip Palmer Press, [1928], 2. ed., pp. 3, 11–51*).—A report of the origin, growth, and functions of this institution, with brief progress reports of experiments in the feeding and nutrition of dairy cattle, the chemistry and bacteriology of milk, and a statement of the need for more extended work (E. S. R., 60, p. 263).

Simplified methods of calculating dairy rations, F. B. Headley (*Nevada Sta. Bul. 116 (1929), pp. 23, figs. 6*).—A discussion of five methods of feeding dairy cows, pointing out the good and bad features of each, together with a résumé of the maintenance requirements and the requirements for milk production. A series of charts is given by means of which the amounts of grain, total nutrients, and protein may be calculated. Other charts provide means for calculating the total digestible nutrients and the digestible protein in various combinations of dairy feeds, and also the cost per pound of these nutrients.

A study of the factors affecting the growth of dairy heifers, II, C. B. Bender and J. W. Bartlett (*Jour. Dairy Sci., 12 (1929), No. 1, pp. 37–48, pl. 1, figs. 4*).—In an effort to find the best possible ration to feed dry that would produce 100 per cent normality in calves at 180 days of age, to find the earliest age to wean calves from a milk diet, and to reduce the cost of raising calves to 6 months of age, the New Jersey Experiment Stations continued the study previously noted (E. S. R., 53, p. 175). The calves used were left with their dams for 36 hours, then placed in individual pens and fed whole milk alone three times daily for the first week. A grain mixture and alfalfa hay were placed before the calves in order that they might become accustomed to it. At 21 days of age the amount of whole milk was gradually reduced until at 30 days the calves were completely weaned. Records were kept of feed consumption and of weight and height increase.

Six groups of calves of 13, 5, 2, 19, 4, and 4 head, respectively, were fed varying grain mixtures composed in general of combinations of yellow corn meal, ground oats, wheat bran, linseed oil meal, and minerals, while other feeds used in one or more rations were skim milk powder and soluble blood flour.

Practically all of the groups slowed up in weight growth the first 10 days on the dry mixture, and this lag sometimes lasted for the first 30 days. However, the animals were 100 per cent normal for weight and height according to the Eckles standard (E. S. R., 43, p. 876) at 180 days of age. By thus successfully weaning the calves at 30 days of age the cost of raising calves to 6 months of age was reduced from $25 to $50, depending upon the method of feeding, without harming the subsequent breeding and producing abilities of the individuals.

Self feeders in dairy calf feeding, T. M. Olson (*South Dakota Sta. Bul. 236 (1929), pp. 16, figs. 7*).—In concluding this study (E. S. R., 56, p. 671), it was found that the palatability and not the nutritional value of a feed was the determining factor in the choice made by calves on self-feeders. When allowed free choice of feeds, calves did not select a ration best suited to their physiological well-being. Usually the ration selected had too narrow a nutritive ratio for an economical ration for producing growth. A control group of calves consumed on the average 43 per cent less concentrates than those on self-feeders, while the average daily consumption of roughage was 3.05 and 0.64 lbs. per head in the respective groups.

Self-fed calves were no higher at the withers after 3 months of age than hand-fed calves, but up to 4 months of age were heavier than the latter calves. However, over a 10 months' period the average daily gains were 1.46 and 1.71

lbs. per head in the respective groups. Free choice of grains resulted in physiological disturbances and abnormal development of many of the calves, beginning at about 4 months of age. However, the self-fed calves that showed no physiological disturbances were heavier than the hand-fed calves at the same age.

There was a great variation in the amount and kinds of feed consumed by the calves on the self-feeders. The feed cost per day, per pound of gain, and per unit of growth was greater for the self-fed calves, particularly in the last-named element, where the cost ranged from 25 to 87 per cent higher than in the case of hand-fed calves.

The relation between weight and fat production of Guernsey cattle, C. W. TURNER (*Jour. Dairy Sci., 12 (1929), No. 1, pp. 60–73, figs. 3*).—Based on the records of the American Guernsey Cattle Club, the Missouri Experiment Station studied the relation between age, live weight, and yearly fat production of more than 2,700 Guernsey cows (E. S. R., 52, p. 478).

The equation "yearly fat production = 0.77 weight − 304.73" shows the direct relationship between weight and fat production, since the increase in yearly fat production and increase of body weight with age follow the same exponential course. When age was constant, there was an increase of only 20 lbs. of fat for each increase in weight of 100 lbs. These figures indicate that only about 25 per cent of the increase in fat production with age is due to the increase in body weight, and that the remainder of the increase is due to the development of the udder during succeeding pregnancies. A partial correlation of 0.249 for weight and fat with age constant was found, which further confirmed the 25 per cent ascribed to the influence of live weight on yearly fat production.

Keeping up milk production in summer, J. K. MUSE ([*Oklahoma*] *Panhandle Sta., Panhandle Bul. 7 (1929), pp. 11–13*).—In this article the author discusses the principal causes of summer declines in milk production, namely, flies, heat, and lack of proper feed.

The microscopic appearance of unpasteurized market milk and cream, R. S. BREED (*New York State Sta. Bul. 566 (1929), pp. 28, figs. 20*).—A series of 20 microphotographs of methylene blue preparations of unpasteurized market milk and cream taken at the magnification ordinarily used in routine examination of milk are published in this bulletin. These plates illustrate the conditions found in normal, good quality milk, in milk from diseased animals, and from poorly cleaned utensils, in milk not properly cooled, and in cream and skim milk. These plates are intended as an aid to laboratory examiners of raw milk samples for interpreting the past history of the milk, and are based on the routine examination of more than 60,000 samples of milk collected in Geneva, N. Y., during the past 12 years (E. S. R., 55, p. 268).

Bacterial counts in sanitary milk control, R. S. BREED (*New York State Sta. Bul. 567 (1929), pp. 25, figs. 10*).—In this publication the author discusses the uses that are being made of bacterial counts in sanitary milk control in New York State, particularly those that affect the producer most directly. The proper methods for sampling milk for bacteriological analysis and the counting of bacteria by the agar plate and the direct miscroscopic method are described.

The system of supervision established by the State for protecting dairymen where bacterial counts are used as a basis of payment is explained.

The sanitary significance of leucocytes in milk, R. S. BREED (*New York State Sta. Bul. 568 (1929), pp. 14, figs. 7*).—It has been found difficult to estimate the true significance of the number of leucocytes and other types of cel-

lular material found in milk without a knowledge of the reason for their presence. Leucocytes may be present in large numbers in milk that is apparently normal so far as the regular chemical and bacteriological examination shows. In this case they usually represent the wastage from the active gland and have no sanitary significance. On the other hand, if a large number of leucocytes with polynuclear types predominant are accompanied by long-chain streptococci and particularly when phagocytes containing bacteria are present, the condition indicates with practical certainty a streptococcic udder infection. Small numbers of leucocytes with no indication of accompanying bacterial infection denote normal milk so far as microscopic examination is concerned. Intermediate conditions are difficult to interpret. Other udder infections may cause an increased number of leucocytes to appear in the milk.

Proteolysis by Streptococcus lactis, L. T. Anderegg and B. W. Hammer (*Jour. Dairy Sci., 12 (1929), No. 2, pp. 114–128*).—Studies were undertaken at the Iowa Experiment Station to determine whether or not the various strains of *S. lactis* commonly isolated in Iowa had a proteolytic action when grown in milk. Cultures containing this organism used for developing flavor and aroma in butter were also studied. Vigorous cultures of the organism were introduced into 200 cc. of sterilized milk, incubated at room temperature, and the soluble portion of each bottle recovered for analysis.

It was found that while certain cultures of *S. lactis* had a definite proteolytic action on milk, others had none. On the other hand, all the butter cultures studied had a proteolytic action. Adding $CaCO_3$ to the milk and agitating occasionally caused more pronounced proteolysis with both the *S. lactis* and butter cultures than when no $CaCO_3$ was used. Sterile lactic acid added in amounts about equal to that developed by *S. lactis* cultures failed to increase the amount of soluble nitrogen.

Analyses indicated that when the amount of soluble nitrogen caused by the growth of *S. lactis* in milk increased, the amount of amino nitrogen as determined by the Van Slyke method usually increased. Protein decomposition was retarded by the addition of peptone. Protein decomposition occurred with *S. lactis* cultures that coagulated milk rapidly, while no decomposition occurred with the slower coagulating cultures. No proteolysis occurred when *S. citrovorus* and *S. paracitrovorus* were grown in milk.

Producing high-quality milk, M. J. Prucha (*Illinois Sta. Circ. 341 (1929), pp. 15, figs. 12*).—In this publication the author discusses the essential qualities which milk must possess in order to be classed as high quality milk. The most important factors in the production of such milk are clean surroundings and animals, properly sterilized utensils, and prompt cooling of milk to 60° F. or lower and holding at that temperature until delivered.

Certified milk conferences held in 1928: Twenty-second annual conference of the American Association of Medical Milk Commissions, Inc., and the Certified Milk Producers' Association of America, Inc. (*Amer. Assoc. Med. Milk Comns. Proc., 22 (1928), pp. IV+[2]+328, pl. 1, figs. 10*).—A compilation of the proceedings of the twenty-second annual conference of the American Association of Medical Milk Commissions, held at Minneapolis, Minn., June 11 and 12, 1928 (E. S. R., 59, p. 575), also the proceedings of the annual meeting of the Metropolitan Certified Milk Producers, held in New York February 6, 1928. Both meetings were held in conjunction with the meetings of the Certified Milk Producers' Association of America.

Metals in dairy equipment: Metallic corrosion in milk products and its effect on flavor, O. F. Hunziker, W. A. Cordes, and B. H. Nissen (*Jour. Dairy

Sci., *12 (1929)*, *No. 2, pp. 140–181, fig. 1*).—To study the corrosive effect of milk and milk products on the various metals used in dairy equipment and the effect of the metals on the milk products, the authors observed 19 different metals, plated metals, and metallic alloys. A strip of each metal was placed in the following solutions: Four organic acids, 2 mineral acids, sweet and sour milks and creams, and sour cream neutralized. Some of the strips were fully immersed in the solutions, and others were immersed to the extent of one-half of their length for periods of 5 days at 70° F. and for 5 hours at 145°. Other strips provided with rivets of different metals to study the effect of metals with different electrical potentials in contact with one another were used. Each strip was weighed before and after immersion and examined for corrosion. In addition, the liquids were studied as to color, precipitates, flavor, and in some cases for metallic salts.

The corrosive effect on the metal was generally more noticeable in the acid solutions than in the milk products, even when the acidity of the milk product was equal to or greater than that of the acid solution. Corrosion was greater on the whole in the high acid products and at high temperatures, although it was not entirely absent in the sweet milk products and at room temperatures. The metals showing the most definite corrosion also had the most marked effect upon the flavor of the milk products.

Based on the effect on the flavor of the milk product and their dependability under conditions of steam, washing solutions, and cooling brines, the metals may be listed as follows according to relative merit: (1) Allegheny metal, tin, and heavily tinned copper; (2) nickel, aluminum, and manganese aluminum alloy; (3) Monel metal, Enduro, Ascoloy, and nickel silver; and (4) tinned iron, copper, galvanized iron, iron, and zinc.

A study of the effectiveness of sodium hypochlorite in sterilizing creamery equipment, E. L. Fouts (*Jour. Dairy Sci.*, *12 (1929)*, *No. 1, pp. 51–59*).—In order to determine the value of commercial sterilizers for destroying bacteria on creamery equipment, the Oklahoma Experiment Station studied chlorine compounds and their use in sanitary piping, pumps, filters, and surface coolers to prevent recontamination of pasteurized milk from these sources. During the control part of the work ordinary washing methods were used, consisting of scrubbing with a hot alkali solution and rinsing with scalding water before using. The same washing methods were used in the experimental part of the work, followed by a solution of the chlorine compound. Samples of milk for bacterial analyses were taken from the vat after pasteurizing and from the trough of the cooler after the milk had passed through the pump, pipes, filter, and over the coolers.

It was found that ordinary washing methods followed by a rinse of scalding water did not sterilize dairy equipment. Sodium hypochlorite and its compounds were effective sterilizing agents when prepared according to the directions of the manufacturers, provided they furnished a minimum of 45 parts of active chlorine per million parts of solution. Sterilizing the equipment with sodium hypochlorite held the bacterial increase from pasteurizer to bottle to 10 per cent.

The use of citric acid and sodium citrate in starter cultures, H. L. Templeton and H. H. Sommer (*Jour. Dairy Sci.*, *12 (1929)*, *No. 1, pp. 21–36*).—In starter studies (E. S. R., 59, p. 75) at the Wisconsin Experiment Station, the effect of the addition of citric acid and sodium citrate on the volatile acidity produced in commercial starters and also a comparison of cultures treated in such manner with untreated cultures for butter making was undertaken. A preliminary study was made of the amount of citric acid present in milk and

the rate at which it disappears in naturally soured milk or in milk soured with pure cultures of organisms.

It was found that under ordinary conditions the citric acid present in milk disappears in from 2 to 4 days. When the milk was allowed to stand after the citric acid had disappeared, a substance of an unknown nature which behaved like the compound formed by mercury and citric acid appeared.

In the study of volatile acids, it was found that 183 analyses of cultures grown in milk without any additions averaged 15.43 per cent of volatile acids, 32 cultures grown in sterilized milk with 0.2 per cent citric acid added averaged 22.42 per cent, 28 cultures grown in pasteurized milk with 0.2 per cent citric acid added averaged 23.1, and 60 cultures grown in pasteurized milk with 0.2 per cent citric acid added as sodium citrate averaged 22.21 per cent of volatile acids. The addition of citric acid or sodium citrate did not increase the total acidity more than 10 per cent. These results indicate that the use of citric acid or sodium citrate with milk intended for starters produced very satisfactory results, and in most cases competent judges preferred the treated to the untreated cultures.

The relations of temperature and time of forewarming of milk to the heat stability of its evaporated product, E. F. Deysher, B. H. Webb, and G. E. Holm (*Jour. Dairy Sci., 12 (1929), No. 1, pp. 80–89, figs. 5*).—The U. S. D. A. Bureau of Dairy Industry in a study of evaporated milk found that the temperature of forewarming was the most important factor in determining its heat stability. When temperatures up to 70° C. were applied for 10 minutes the stability was decreased, but higher temperatures markedly increased the stability. Higher temperatures and longer heating periods than those commonly used further increased stability, but such treatment gave a resultant product with an objectionable body. Homogenization at pressures up to 4,000 lbs. of an evaporated milk containing 18 per cent solids-not-fat and 8 per cent fat affected its heat stability only to a very limited extent.

The nutritional value of copper in powdered whole milk, R. W. Titus and J. S. Hughes (*Jour. Dairy Sci., 12 (1929), No. 1, pp. 90–93, fig. 1*).—Weekly weights and hemoglobin determinations were made on young rats at the Kansas Experiment Station to determine the deleterious effect of copper on the nutritional value, flavor, and keeping qualities of condensed and powdered milk. Powdered whole milk containing 0.0006 per cent of copper was fed to two lots of 4 and 5 rats, respectively, in such amounts that each rat received approximately 0.05 mg. of copper daily. One lot received in addition 0.5 mg. of iron per head daily.

The rats receiving the powdered whole milk only failed to grow and became anemic. The rats receiving the iron supplement showed good growth and hemoglobin production during the 10 weeks' experimental period. These results indicate that the copper content of powdered whole milk may have a beneficial effect.

The effects of certain salts on the physical properties of ice cream mixes, J. C. Hening and A. C. Dahlberg (*Jour. Dairy Sci., 12 (1929), No. 2, pp. 129–139*).—Since there is a natural variation in the amount of salts present in milk, the New York State Experiment Station undertook to determine the effect of adding sodium and calcium salts on the viscosity, ease of whipping, and fat globule clumping properties of ice cream mixes. These salts, which naturally occur in milk, were compared with those used as neutralizers. A standard ice cream mix was prepared, pasteurized, and homogenized, and the varying salts were added as a concentrated solution either before or after processing.

When added before pasteurization and homogenization, sodium citrate, potassium oxalate, and disodium phosphate reduced the viscosity of ice cream mixes, caused them to whip more readily, and reduced the size of the clumps of fat globules. Calcium lactate, on the other hand, increased the viscosity and size of fat clusters and made mixes more difficult to whip. None of these salts had any marked effect on viscosity or size of fat clusters when added after homogenization, but in some cases did affect the ease of whipping.

Natural increases of lactic acid to about 0.3 per cent or the addition of lactic or citric acid before processing brought about a slight curdling at the time of homogenization, and made the mixes very viscous and hard to whip. The resultant ice cream was hard and crumbly. Adding oxalic acid either before or after homogenization or adding lactic or citric acid after homogenization did not have this effect. Sodium bicarbonate and sodium hydroxide when used to neutralize mixes with a titrable acidity of 0.28 to 0.3 per cent made them less viscous and easier to whip, while calcium hydroxide did not produce this effect. The sodium bicarbonate produced ice cream of better flavor than the other neutralizers.

Unusually viscous but easily whipped mixes were made by using unsalted butter, skim milk powder, skim milk, and water in their preparation. These mixes, which were high in acidity before processing, whipped more easily than those of normal acidity.

These results indicate that the relative amounts of sodium and calcium salts in normal dairy products vary enough to affect the whipping properties of ice cream mixes made from them. Difficult whipping and very viscous mixes were corrected by adding 0.1 per cent of sodium bicarbonate before pasteurization.

Lowering weight-texture handicaps on plant-packaged ice cream, K. E. Wright (*Ice Cream Trade Jour., 25 (1929), No. 2, pp. 49–51, 88, figs. 5*).—A study of dipped package ice cream and plant-packaged ice cream was made at the Massachusetts Experiment Station to determine methods for maintaining the quality of texture and the weight of factory products as compared with the dipped product. The basic mix used had an approximate composition of 12 to 14 per cent of fat, 10 per cent of serum solids, 15 per cent of sugar, and 0.35 per cent of gelatin. The mixes were pasteurized at 150° F. and homogenized at 2,500 lbs. pressure.

The results indicated that when a mix of the above composition to be used for factory filled packages was allowed to reach a temperature above 25.5° previous to hardening, a coarse-textured product resulted. For obtaining a product of satisfactory weight, it was necessary to have the scraper blades of the freezer sharp and properly aligned and to have a sufficient flow of brine at a temperature not above 5°. Using either 0.15 per cent of calcium lactate or 0.3 per cent of egg yolk, adding gelatin to the cooled mix, substituting part butter for cream, or increasing the fat content aided in producing a factory packed ice cream of the desired smoothness and weight.

The bacterial count of ice cream held at freezing temperatures, J. Weinzirl and A. E. Gerdeman (*Jour. Dairy Sci., 12 (1929), No. 2, pp. 182–189*).—Samples of ice cream from two wholesale makers were stored soon after freezing as follows: Twelve samples at −3° C., 12 at −6°, and 9 at −10° for 30 days. Portions of the ice cream were removed every other day, plated with standard beef extract agar, incubated for 48 hours at 37°, and the plates showing between 50 and 300 colonies counted.

The results indicate that storage of ice cream at −10° or above does not entirely inhibit the growth of certain bacteria or prevent an increase in the

bacterial count. The reason for the increase in the total counts of bacteria in samples of ice cream from retailers as compared with the counts in samples from producers is at least partially explained by these results.

Comparing gelatine by grade, A. B. QUENCER (*Ice Cream Trade Jour.*, 25 (1929), No. 2, pp. 67, 68).—A comparison of 20 samples of commercial gelatins was made at the New York Cornell Experiment Station. Bacterial content, acidity, and gel value were determined on the samples, arranged in four classes according to their selling price.

No relationship was found to exist between the bacterial counts of the samples and their grades on the basis of selling price. The acidity varied more according to the source of the sample than to any differences in grade. The gel strength was the only characteristic studied that showed any relation to the price of the gelatin, and in this case the high-priced gelatins showed the greatest gel strength. Gel strength was tested both in water and in skim milk, and the results of these tests indicated that a little more gelatin had to be used when the water solvent test was the basis of calculation.

VETERINARY MEDICINE

A text-book of pathology, W. G. MACCALLUM (*Philadelphia and London: W. B. Saunders Co., 1928, 4. ed., rev., pp. XVI+1177, figs. 606*).—In this edition of the work previously noted (E. S. R., 49, p. 278) a very complete revision has been attempted, almost every chapter having been in part or completely rewritten.

Practical parasitology, E. BRUMPT and M. NEVEU-LEMAIRE (*Travaux Pratiques de Parasitologie. Paris: Masson & Co., 1929, pp. VI+301, figs. 202*).—This is a practical account.

Annual report on the Punjab Veterinary College, Civil Veterinary Department, Punjab, and the Government Cattle Farm, Hissar, for the year 1927–28, J. SINGH, W. R. WILSON, W. TAYLOR, T. F. QUIRKE, and R. BRANFORD (*Punjab Vet. Col., Civ. Vet. Dept. [etc.] Ann. Rpt. 1927–28, pp. IV+7+36+[1]+XXXVI, pls. 12*).—This is the usual annual report (E. S. R., 58, p. 171).

A note on the interaction of pituitrin and insulin, M. UMEZU and T. SCHIMAMURA (*Jour. Japan. Soc. Vet. Sci., 7 (1928), No. 1, pp. 1–10, figs. 2; Japan. abs., pp. 9, 10*).—Following a reference to the literature, experiments conducted by the authors are reported. It is pointed out that pituitrin causes hyperglycemia, as observed by earlier writers, although it is supposed that it does not cause glycogenolysis in the liver directly, since no apparent pituitrin hyperglycemia can be observed in adrenalectomized rats. Pituitrin may affect indirectly the blood sugar content, stimulating to increase the secretion of adrenal hormone. The data thus far obtained have not furnished sufficient evidence that pituitrin is a simple antidote for insulin.

A contribution to the study on heterogeneous antigen and antibody [trans. title], Y. TERAKADO (*Jour. Japan. Soc. Vet. Sci., 7 (1928), No. 1, pp. 11–42; Eng. abs., pp. 41, 42*).—The author has proved that a strain of *Bacillus bovisepticus* and one of three strains of *B. lepisepticus* which he isolated from rabbit septicemia have the same heterogeneous antigenic property.

Discrepancies of the agglutination test in Brucella abortus infection in cattle, J. TRAUM and B. S. HENRY (*Cornell Vet., 19 (1929), No. 2, pp. 105–123, figs. 9*).—In the comparative agglutination tests at the California Experiment Station with antigens made from a number of strains of *B. abortus* from bovine source, differences in agglutinability of the strains were observed.

"In most, these differences were so slight as to be of no importance. These we considered as 'good' antigens. Other strains would differ from the 'good' ones in consistently giving partial or complete agglutination in all negative cow sera and would materially enhance the titer of sera with low agglutinin content. The cause for this difference was traced to a high proportion of rough or intermediate variants in the bad antigens. Self-agglutinability and difficulty in suspending these variants only partly explains these pseudopositive reactions, since the antigen controls without serum were either negative or showed slight agglutination. We could not satisfactorily associate this behavior with conglutinins present in bovine serum. It was also observed that the concentration of serum influenced these false positives, and that it was possible in one trial to eliminate the pseudoreactions by absorbing the serum with the rough variant."

Effect of ultra-violet light on the viability of the virus of foot and mouth disease, I. A. Galloway and A. Eidinow (*Brit. Jour. Expt. Path., 9 (1928), No. 6, pp. 326–329*).—The authors find that the virus of foot-and-mouth disease in filtrates is destroyed after 5 minutes' exposure to the radiations of the mercury vapor lamp in quartz flasks, which transmit radiations of wave lengths from 5,720–2,300 a. u. It is inactivated after 30 minutes' exposure to the rays of the mercury vapor lamp filtered through a sheet of Vitaglass which allows the passage of rays of wave lengths from 5,720–2,800 a. u. The rays of wave lengths 5,720–2,300 a. u. have no lethal action on the virus of foot-and-mouth disease. When the virus was suspended in unfiltered lymph or serum, a protective action due to selective absorption by the suspending fluid was observed.

Heartwater (R. ruminantium), J. Walker (*Kenya Colony Dept. Agr. Bul. 25 (1929), pp. 10, pls. 2, fig. 1*).—A practical summary of information on this tick-transmitted disease of cattle, sheep, and goats.

Filterable virus and Rickettsia diseases in the Tropics, II, III, E. B. McKinley (*Porto Rico Rev. Pub. Health and Trop. Med., 4 (1929), Nos. 8, pp. 344–364; 9, pp. 392–415*).—A continuation of the account previously noted (E. S. R., 61, p. 269), which includes a discussion of epithelioma contagiosum (pp. 403–407).

Experiments on the rinderpest vaccine, C. Kakizaki, S. Nakanishi, J. Nakamura, and Y. Toshijima (*Jour. Japan. Soc. Vet. Sci., 7 (1928), No. 3, pp. 207–218; Japan. abs., p. 218*).—The authors report upon (1) experiments with preservatives for rinderpest vaccine and (2) a comparison made of the glycerinated rinderpest vaccine with that prepared by employing a physiological saline solution.

The carbolized vaccine was found to be much inferior to the toluolized. Neither oleum eucalypti (1.5 per cent) nor toluol exerted any influence upon the antigenic power of the rinderpest vaccine, and there was no difference in their effectiveness and preservative power. Vaccine made with a physiological salt solution is in no way inferior to the glycerinated in its preservation and effectiveness, and it can be prepared much more economically.

Zone phenomena in in vivo trypanolysis and the therapeutic value of trypanolytic sera, W. H. Taliaferro and T. L. Johnson (*Jour. Prev. Med., 1 (1926), No. 1, pp. 85–123, fig. 1*).—The authors find that serum taken from guinea pigs or rabbits after infection with *Trypanosoma equinum* and after the first trypanolytic crisis or from infected sheep during the chronic infection will often produce a trypanolytic crisis in mice previously infected with the passage strain. "The length of life of such treated mice is prolonged over that of untreated mice approximately the same number of days that the artificial crisis lasts. In mice infected with the passage strain and given a series of increasing doses of immune serum, some doses will often produce a crisis

while larger doses are not effective. There may be several recurring 'zones of inhibition' of lytic function within a single series. Zonal phenomena are not dependent upon inactivation. They occur with trypanolytic sera arising during the uninfluenced course of infections in guinea pigs, rabbits, and sheep, and in infected mice after treatment. Zonal phenomena were observed in neither fresh nor inactivated normal human serum, which is markedly trypanocidal in vivo.

"The therapeutic value of immune trypanolytic serum, as measured by length of life of the mice, is dependent upon the occurrence of trypanolysis and not upon the size of the dose. Thus, when trypanolysis is inhibited in a larger dose, length of life is not increased over the control, whereas in smaller doses with trypanolysis, it is increased. Furthermore, the increase in length of life is approximately the same whether the crisis was brought about by a small or a large dose of immune serum."

The non-occurrence of the zone phenomenon in the curative action of drugs and normal human serum in Trypanosoma equinum infection, T. L. JOHNSON (*Amer. Jour. Hyg., 9 (1929), No. 2, pp. 283-291*).—"Zones of effectiveness and noneffectiveness of immune serum in vivo analogous to the Neisser-Wechsberg phenomenon in vitro have been previously described in mice infected with *T. equinum* [see above]. The present work involving 16 series containing a total of 280 mice would seem to indicate that a similar phenomenon does not occur when a series of infected mice are treated with graded doses of several of the trypanolytic drugs, but that all doses above the minimal effective dose destroy the trypanosomes. Likewise, from a study of 5 series involving a total of 75 mice, all doses of normal human serum above the minimal trypanocidal dose destroy the trypanosomes."

The vacillation of the Wassermann and Sachs-Georgi reaction in the experimental trypanosomiasis of animals [trans. title], S. AKAZAWA, S. ITO, and K. KASAI (*Jour. Japan. Soc. Vet. Sci., 7 (1928), No. 1, pp. 54-85; Eng. abs., pp. 83-85*).—This is a report of experiments conducted in which the trypanosome employed is said to have been identical with *Trypanosoma evansi*, having been isolated from a water buffalo in Taiwan.

Comparison of Germanin and Naganol in the antitrypanosomal and antispirochetal activities: Behavior of Trypanosoma gambiense, T. evansi, and T. equiperdum against the prophylactic action of Bayer 205 [trans. title], S. AKAZAWA (*Jour. Japan. Soc. Vet. Sci., 7 (1928), No. 2, pp. 1-18, [91-108]; Eng. abs., pp. 17, 18 [107, 108]*).—It is concluded from the results obtained that Germanin is more effective than Naganol both in its prophylactic and therapeutic action on trypanosomal and spirochetal infection. By the prophylactic application of Bayer 205 (0.005, 0.0001, and 0.00003 gm.) the duration of protection is shortest against the most virulent *T. gambiense*, longer against the less virulent *T. evansi*, and longest against the least virulent *T. equiperdum*.

On the nature of the tuberculin hypersensitiveness [trans title], K. TSUGE (*Jour. Japan. Soc. Vet. Sci., 6 (1927), No. 3, pp. 285-314; Eng. abs., p. 314*).—The author reports upon experimental work conducted in which the ophthalmic reaction was applied to the rabbit. It was found that not only living tubercle bacilli but also dead (heated) bacilli have the ability to actively hypersensitize animals against tuberculin. Passive tuberculin hypersensitiveness was established from 24 to 48 hours after the serum injection and disappeared within 2 or 3 days.

Subcutaneous lesions which sometimes induce tuberculin hypersensitiveness in cattle, W. A. HAGAN (*Cornell Vet., 19 (1929), No. 2, pp. 173-182*).—The author reports that in 27,000 reacting cattle originating in New York which

were slaughtered at the Federal establishments in Buffalo during 1926 and 1927, nearly 900 showed lesions of the skin. Reference is made to the study of skin lesions by a number of investigators. It has been found that lesions may occur in connection with the skin of any part of the body, but they are rarely found in any part except on the legs, and usually on the lower parts of the legs. While the skin lesions exhibit varying structure, it is considered likely that they are due to a common causative agent.

Experimental studies with B. C. G. vaccine, M. J. King (*Cornell Vet., 19 (1929), No. 2, pp. 96–104*).—The author has been unable to produce evidence of infection by the vaccine or of protection by it in guinea pigs through feeding the B. C. G. to newborn pigs and calves. In fairly young but not newborn monkeys, on the other hand, there was evidence of slight absorption of the vaccine, four monkeys out of nine which were fed the vaccine having been found at autopsy to have localized tubercles in the mesenteric nodes with further involvement of the spleen in two.

"The results in the attempt to produce immunity by vaccinating animals subcutaneously were suggestive. With a few exceptions vaccinated animals which were later infected with virulent organisms developed more or less progressive tuberculosis, but they generally developed the disease to a less extent than nonvaccinated controls which received the same injections of virulent organisms. We feel that the continuous cultivation of our B. C. G. organisms on the glycerinated ox-bile potato medium has maintained the attenuation of the vaccine. However, we do not feel justified in drawing conclusions as to the absolute safety of the B. C. G. vaccine until further experimentation has been done covering a period of years on vaccinated animals. We can not emphasize too strongly the importance of continuous cultivation of the B. C. G. on the bile medium.

"None of the guinea pigs and calves fed the vaccine developed hypersensitiveness to tuberculin, while a large majority of those receiving the B. C. G. subcutaneously and intraperitoneally became allergic. The hypersensitiveness usually appeared by the eighth week and seemed to last on an average from 6 to 10 months."

Maintaining the health of livestock in transit, A. W. Miller (*U. S. Dept Agr. Leaflet 38 (1929), pp. 8, figs. 9*).—A practical summary of information on the subject.

The physiology of milk fever.—III, The blood phosphates and calcium, P. A. Fish (*Cornell Vet., 19 (1929), No. 2, pp. 147–160, figs. 9*).—The author reports (E. S. R., 59, p. 474) that in 18 cases of milk fever the blood phosphates were uniformly and consistently lower than normal. The calcium was likewise found to be subnormal. Both phosphates and calcium were reduced 50 per cent or more in amount in the pre-inflation samples.

On the antigen for complement fixation test in contagious pleuropneumonia in cattle, H. Futamura and T. Watanuki (*Jour. Japan. Soc. Vet. Sci., 6 (1927), No. 4, pp. 364–379; Japan. abs., p. 379*).—An emulsion made from colonies on solid media is the most specific and potent in its antigenic power, although the glucose-serum-bouillon culture can also be used as a valuable antigen.

Urocystitis haemorrhagica of native cattle in Formosa, T. Miyamoto (*Jour. Japan. Soc. Vet. Sci., 7 (1928), No. 3, pp. 190–206; Japan. abs., pp. 205, 206*).—The author has found the hematuria occurring in native yellow cattle and water buffaloes to be quite different from the hemoglobinuria hitherto observed in other cattle, and also from the hematuria which develops from some other causes.

On the "wahi" or "kose" disease, an elephantiasis-like disease, in cattle, II [trans. title], H. OGUNI (*Jour. Japan. Soc. Vet. Sci., 7 (1928), No. 3, pp. 219–242, pl. 1; Eng. abs., pp. 240–242*).—This is a continuation of the studies previously noted (E. S. R., 58, p. 474).

When embryos were placed in the abdominal cavity of rabbits, microfilaria appeared in the blood of the rabbits three days later and were present in maximal numbers on the tenth day. Two forms were represented, one identified as *Setaria labiato-papillosa* and the other as *S. digitata*.

Treponema podovis n. sp., the pathogenic cause of foot rot in sheep [trans. title], L. and P. BLAIZOT (*Compt. Rend. Acad. Sci. [Paris], 187 (1928), No. 20, pp. 911, 912; trans. in Vet. Rec., 9 (1929), No. 5, pp. 95, 96*).—The name *T. podovis* is given to the spirochete of foot rot detected by the authors in France.

An additional study of caprina, the prophylactic vaccine for sheep pox [trans. title], H. KASAI (*Jour. Japan. Soc. Vet. Sci., 6 (1927), No. 3, pp. 241–272; Eng. abs., pp. 271, 272*).—In repeating the work of Konew in 1907 (E. S. R., 19, p. 1185), sheep pox virus was passed through goats in 15 successive cutaneous inoculations. Almost similar eruptions resulted in every generation without a gradual increase of the virulence against the goat or a gradual decrease of eruptions during certain generations in the primary stage as observed by the author in successive cutaneous inoculations of sheep with the cow pox virus.

The animals employed for the passage of the sheep pox virus maintained not only perfect immunity against the introduced virus but also remained refractory to the revaccination with sheep pox virus thereafter, although apparently susceptible to cow pox virus. Further, the caprinized sheep pox virus produced typical eruptions on normal sheep, but no reaction was observed in sheep previously immunized against sheep pox.

It is concluded that the sheep pox virus passed through goats by cutaneous inoculation shows a remarkable decrease in its virulence against the sheep. No symptom of sheep pox is observed by injection of the virus by any route, cutaneous, subcutaneous, or intravenous, nor does it recover the virulence by inoculating into sheep, even in succession.

Hog cholera results in Maryland in 1927, I. K. ATHERTON (*Md. Agr. Soc., Farm Bur. Fed., Rpt., 12 (1927), pp. 476–487*).—This is a detailed account of the results of control work in 1927 by the inspector in charge of the work in the State.

A new larval nematode (Anisakinae) found in the stomach of swine, S. ITAGAKI (*Jour. Japan. Soc. Vet. Sci., 7 (1928), No. 2, pp. 19–21 [109–111], pls. 2; Japan. abs., p. 21 [111]*).—The author describes and illustrates a parasite taken from the stomach of swine at Tokyo as belonging to the subgenus Anisakinae.

Strongyloidosis intestinalis of farrow in Formosa, T. MIYAMOTO (*Jour. Japan. Soc. Vet. Sci., 7 (1928), No. 1, pp. 43–53; Japan. abs., p. 53*).—The author finds that the disease known as "white diarrhea" of pigs by the natives in Taiwan is caused by *Strongyloides suis*. The injury may be caused by the parasite directly, or indirectly by complications with other pathogenic agents.

Experimental studies on osteomalacia in the horse (*Jour. Japan. Soc. Vet. Sci., 6 (1927), Nos. 3, pp. 273–284, pls. 4, Japan. abs. p. 284; 4, pp. 345–359, pls. 4, Japan. abs. pp. 358, 359; 7 (1928), No. 3, pp. 181–189, pls. 7, Japan. abs. pp. 188, 189*).—Three reports are here given.

Etiological significance of calcium deficiency in the diet, Part I, K. Niimi.—Two horses fed on barley in the course of five months developed the changes

generally observed in osteomalacia. The clinical symptoms and pathological changes were in agreement and more pronounced in the younger horse, and are here reported. The findings led the author to conclude that all the changes noticed in the experimental osteomalacia in the horse fairly agree with those of the natural type of the disease, and that this may be principally due to a deficiency of calcium salts in the diet.

Etiological significance of calcium deficiency in the diet, Part II, K. Niimi and M. Aoki.—The results here obtained again led to the conclusion that the deficiency of calcium salt in the diet is a factor influencing the occurrence of osteomalacia. The disease was produced artificially in the horse by feeding it on barley only, and the onset was shortened by two months. The metabolism in the horses fed on barley with calcium carbonate was found to be normal.

A list is given of 25 references to the literature.

Effect of the treatment by means of compensation of calcium carbonate, K. Niimi and K. Kato.—These experiments led to the conclusion that osteomalacia of the horse can be cured within 100 days when the horse is fed on an ordinary diet to which a suitable amount of calcium carbonate has been added to increase the alkalinity.

A new filtrable virus disease of fowls observed in Egypt [trans. title], E. Lagrange (*Bul. Soc. Path. Exot., 22 (1929), No. 2, pp. 64–68; abs. in Jour. Trop. Med. and Hyg.* [*London*], *32 (1929), No. 10, p. 143*).—An extremely fatal epizootic occurs in Egypt and periodically ravages poultry. It is characterized by diarrhea, edema of the head, a flow of nasal liquid, nervous troubles of the posterior region, and a continual tendency to sleep. The animal may be found dead before it has shown any symptoms and no lesion be detected at autopsy. In the laboratory, with normal virus, the disease is transmitted about six days after intramuscular injection of virulent blood or by ingestion of sufficient quantity of the organs. The disease, which always proves fatal, is transmissible to the sparrow either by injection or ingestion of blood, the organs, the excrement, or nasal exudate. Nonaffected fowls can be kept free from contagion by isolation and disinfection of food. It is said to differ from Newcastle disease as described by Doyle (E. S. R., 58, p. 77).

The occurrence and significance of Salmonella pullorum in eggs, R. P. Tittsler, B. W. Heywang, and T. B. Charles (*Pennsylvania Sta. Bul. 235 (1928), pp. 16, fig. 1*).—The authors' investigations, here reported in connection with 20 references to the literature, show that practically every hen having ovarian *S. pullorum* infection will, eventually, produce infected eggs. The average percentage of egg infection is relatively low but varies with the individual. The occurrence of infected eggs is very irregular. Some infected hens may be good layers and produce a high percentage of fertile eggs. It has been found that breed is not a factor in the percentage of egg infection. Although carrying ovarian infection, hens may give a negative agglutination test when out of production. Egg infection due to organisms other than *S. pullorum* is very low, indicating that most eggs are sterile.

The details of the investigations are presented in tables that are appended.

The control of bacillary white diarrhoea of chickens, D. C. Matheson (*Vet. Rec., 9 (1929), No. 23, pp. 490–495*).—This is a practical discussion of control measures, presented in connection with a list of 21 references to the literature.

Control of fowl pox, C. E. Sawyer (*Western Washington Sta. Bul. 12–W (1929), pp. 24, figs. 5*).—This is a summary of information based upon experimental work conducted during the past 4 years in an attempt to develop a successful method of vaccination against fowl pox. The author reports that

the cutaneous application of a vaccine containing fowl pox virus has produced complete protection against subsequent natural infection of fowl pox in over 5,000 chickens at the station during the past 3 years. Of over 500 of these vaccinated birds which had been inoculated on the comb, 4 developed lesions of pox. Immunity to artificial inoculation is said to have lasted 2 years in 79 out of 80 birds in one of these groups. The virus applied to denuded feather follicles without scarification was found to produce immunity to subsequent artificial comb inoculation. The vaccination as conducted is said to be dangerous when applied to laying birds during cold weather, but vigorous birds between 3 and 4 months of age were vaccinated during warm weather with no apparent bad effects.

Field trials on 37 pullet flocks during the summer of 1928 were not satisfactory in all flocks. A high mortality followed vaccination reaction in a few flocks, and natural pox infection was reported in 8 flocks during the fall. These cases of natural infection included before January 1, 1929, slightly more than 1 per cent of 55,000 birds which were vaccinated in these field trials.

Fowl pox, F. R. BEAUDETTE (*New Jersey Stas. Hints to Poultrymen, 17 (1929), No. 8, pp. 4*).—This is a brief practical summary of information.

Parasitic worms of Hawaiian chickens with a description of a new trematode, J. E. GUBERLET (*Amer. Micros. Soc. Trans., 47 (1928), No. 4, pp. 444–453, figs. 5*).—This contribution includes an account and description of a trematode taken from the ceca under the name *Harmostomum* (*Postharmostomum*) *hawaiiensis* n. sp.

Confinement rearing in the control of intestinal parasites of chickens, E. L. BRUNETT (*Cornell Vet., 19 (1929), No. 2, pp. 165–172, figs. 3*).—This is a report of control work with tapeworms and coccidia, the most common forms of intestinal parasites menacing poultry flocks.

Nutritive observation of chicken coccidiosis, S. NOHMI (*Jour. Japan. Soc. Vet. Sci., 6 (1927), No. 4, pp. 360–368, pls. 2; Japan. abs., p. 368*).—In the two experiments conducted, the groups of chickens infected with coccidiosis lost body weight suddenly on the fifth and sixth days after infection. In the other groups irradiation with mercury quartz lamp resulted in instant recovery from the abnormal condition. The groups which were not irradiated remained in poor condition and were affected with rickets. However, those affected with rickets after coccidiosis could be cured by irradiation with the mercury quartz lamp. New oocysts in feces were found first on the fourth day after infection, reaching the largest number on the fifth or sixth day and gradually decreasing in number day after day until at last no more oocysts were found in 5 or 6 weeks.

Studies on the life cycle of Heterakis papillosa (Bloch), H. P. DORMAN (*Amer. Micros. Soc. Trans., 47 (1928), No. 4, pp. 379–413, figs. 22*).—In a study made of 95 adult chickens from Champaign-Urbana, Ill., and Rochester, Minn., the average incidence of infestation by *H. papillosa* was 68.4 per cent.

A few embryos reach the infective stage within 9 to 11 days if they are incubated in 2 per cent formalin at 33° C. Eggs will develop also at temperatures ranging from 17° to 42°, but development proceeds more rapidly at 33° than at any other temperature. However, for good results in experiments, eggs which have been incubated from 14 to 20 days or longer should be fed. Larvae migrate directly to the ceca or are voided in the feces. They were recovered throughout the alimentary canal within 6 hours after the first ingestion of embryos.

The life cycle is direct. It was found that the host may be infested by the ingestion of eggs which have undergone a period of incubation outside of any organism, and adult worms, capable of producing eggs, may be recovered in

the ceca, the natural seat of infestation. No intermediate host is necessary for the completion of the life cycle. The ingestion of larvae does not produce infestation, which indicates that hatching must occur within the definitive host. Infective hatching occurs posterior to the gizzard.

A list of 47 references to the literature is included.

On the nematode parasite Streptocara crassicauda in the gizzard of Formosan domestic duck [trans. title], M. SUGIMOTO (*Jour. Japan. Soc. Vet. Sci., 6 (1927), No. 4, pp. 380–386, pl. 1; Eng. abs., pp. 384, 385*).—A description is given of *S. crassicauda*, (Creplin, 1829), found very commonly in the musculature of gizzard of the Formosan domestic duck.

A new species of gapeworm from the robin, H. W. MANTER and H. E. PINTO (*Amer. Micros. Soc. Trans., 47 (1928), No. 4, pp. 454–459, figs. 12*).—Under the name *Syngamus tenuispiculum* n. sp. the authors describe a new gapeworm found in the spring and summer of 1927 to be common in the robin in Nebraska.

On the trematode parasites (genus Philophthalmus) found in the eyes of Formosan domestic birds [trans. title], M. SUGIMOTO (*Jour. Japan. Soc. Vet. Sci., 7 (1928), No. 2, pp. 22–34 [112–124], pl. 1; Eng. abs., pp. 32–34 [122–124]*).—Under the name *P. anatinus* n. sp. the author describes a trematode taken from the nictitating membrane of the Formosan duck. A species taken from the nictitating membrane of the chicken is thought to represent *P. gralli* Maths. and Légfr.

The life history of Prosthogonimus putschkowskii found in the vicinity of Mukden, South Manchuria, I, S. ONO (*Jour. Japan. Vet. Sci., 7 (1928), No. 4, pp. 290–294, pls. 2; Japan. abs., pp. 293, 294*).—The author has found the dragon fly *Anax parthenope* to be the intermediate host of *P. putschkowskii* in the vicinity of Mukden. Three species of dragon flies other than Anax, namely, *Sympetrum* spp. and *Orthetrum* sp., are always free from the encysted larvae of this trematode. The cockerel can be experimentally infested with this parasite, especially when harbored in the bursa fabricii.

AGRICULTURAL ENGINEERING

The results and significance of the Spur (Texas) run-off and erosion experiments, R. E. DICKSON (*Jour. Amer. Soc. Agron., 21 (1929), No. 4, pp. 415–422*).—A description is given of the run-off and erosion experiments being conducted by the Texas Experiment Station at the Spur Substation, and the progress results are reported.

The project embraces a series of eight small control plats, 1/75 acre in size, 6 ft. wide, and 96.8 ft. long. They are bordered with heavy galvanized iron, having calibrated concrete tanks at the lower ends with sufficient capacity to hold the water lost and the soil eroded during the heaviest rain periods. In addition to the control plats in the layout of this experiment there are 10 field areas, each approximately 10 acres in size. At the lower corner of six of these areas is a concrete weir and an automatic water stage recorder which furnishes a definite measure of the amount of water that passes from the area. Two other field areas are so terraced as to hold all of the water that falls on them, and the remaining two hold all of the water that falls on the land and an additional measured amount that comes as run-off losses from other areas.

The experiments on the effect of slope on water losses from land planted to cotton showed that in each of three years the level plat had comparatively small water losses or about one-fifth as much as the plat with a 1 per cent grade. The same relative difference does not exist between the plats with a

1 and 2 per cent grade, the difference in the water losses being small and fairly consistent through the three years. This indicates rather clearly that it does not require much of a slope for water to flow off the land. Probably the greatest beneficial results can be secured by water conservation practices and at a minimum cost on comparatively level land.

The experiments on the effect of crop on water losses showed that Buffalo grass has been the most effective crop in preventing water losses and since becoming fully sodded has been practically perfect in preventing run-off. There is little cause to question the fact that the water losses from grazing land have been materially increased by overpasturing and that this practice has resulted in the destruction of this natural obstruction to water movement. There is also much evidence that the milo plant, acting as a cover crop while growing and later furnishing a large plant litter, is far superior to cotton in preventing run-off water losses.

In experiments with the effect of tillage on water losses a fallow plat spaded to a depth of 4 in. in the winter lost a little more than one-half as much water in 1927 and 1928 as a fallow plat not spaded or cultivated but which had the weeds removed with a hoe. It appears from the measurements of losses occurring, and also from other observations made during the three years, that cultural methods can be improved in so handling row crops as to maintain the surface soil in a better condition to prevent run-off water losses. Recent experiments on the effects of cultivation show conclusively that the greatest beneficial result is the destruction of weeds whose growth makes heavy drafts on the moisture and available plant food supply. It thus appears that tillage studies having for their objective the prevention of water losses are needed.

It was also found that the soil losses from the control plats are highly correlated with the water losses. Soil eroded and carried to the pits with each 1,000 gal. of water has been approximately the same for the various plats. It appears that water and soil losses are concomitant and that any practice that accentuates water movement from the land at the same time creates an accelerated soil movement in the same direction.

The field terracing results appear to be in favor of the level terraces as regards crop yields.

Report of proceedings of Conference on Electricity Supply in Rural Areas, H. E. HAWARD, D. NEWTON, J. T. H. LEGGE, ET AL. (*London: Electricity Comn., 1928, pp. 84*).—These proceedings consist mainly of reports by two subcommittees and considerable appended data.

The first subcommittee draws the striking conclusion that much uncertainty attaches to any generalizations as to potential demand which are based entirely or mainly on results obtained or shown to be possible in particular areas. Short of a preliminary survey of the possibilities in a number of typical unsupplied districts, it appears to the subcommittee that there are considerable difficulties in the way of arriving at any reliable forecast of the potential demand for electricity during the course of the next 10 years in the rural districts of Great Britain taken as a whole.

It is evident that for economic reasons rural electrification can not be proceeded with to the extent of placing a supply of electricity at the service of every inhabitant, farm, and other premises throughout rural Britain. The prospects in the sparsest and most remote areas are of such a low order as to preclude, or at any rate delay for many years to come, the establishment of a public supply on a remunerative basis even under the most favorable conditions of capital expenditure on rural distribution. It has been variously estimated that up to 50 per cent of the more sparsely populated rural portions of the country is likely to fall within this category.

With regard to the suburban and less sparsely populated rural areas, the prospects of demand are of a much more encouraging character and likely to justify the extension of an electrical service to a considerable proportion of the population of such areas. This development can only proceed by stages, and in view of the natural tendency to deal initially with the nearer and most promising centers of load, some time must elapse before electrification can be carried to the more remote centers on the outskirts of areas of supply.

The second subcommittee concludes that from the point of view of potential consumers in average middle or working class houses, the chief deterrent to the adoption of electricity or to the extended use of electricity after adoption for lighting purposes only is the cost of electrical wiring and apparatus. This factor assumes special prominence in the case of rural electrification schemes owing to the generally lower spending power of the population served; and the successful development of supplies in rural areas will largely turn upon the machinery provided for financing such costs.

The experience of supply authorities at present engaged in rural development shows that the wiring installations in rural premises of an average character range from 6 to 12 points, inclusive of plug points in cases where the supply is used for heating and domestic appliances. The wiring is usually carried out on the surface system.

For the power requirements on the average farm a 5-h. p. electric motor is usually found to be ample. If supplied by means of a flexible cable and mounted on a wheeled bearer the motor can be moved from point to point and coupled by a belt to different machines as desired. In many cases, however, farmers are found to prefer an installation of several motors, ranging from 1 to 5 h. p. and fixed for separate duties in the farm buildings, although this entails a greater initial cost both for wiring and motors. A motor of about 15 h. p. is normally required for threshing purposes or of about 20 h. p. for threshing and binding; but on many of the smaller farms the threshing is carried out by a traveling steam plant which is hired for the necessary period.

The subcommittee is definitely of the view that the success of rural electrification is essentially dependent upon the provision of the best possible facilities in the way of assisted wiring schemes and the hire and hire-purchase of apparatus for all classes of consumers.

Natural draft dairy stable ventilation, H. W. Riley (*Agr. Engin., 10 (1929), No. 4, pp. 125–127, figs. 8*).—In a contribution from the New York Cornell Experiment Station the results of experiments on the natural ventilation of dairy stables are reported and discussed. These indicate that the locations of the outtake flues have a completely negligible effect on the convection currents of the stable air, and that it is not necessary to have a number of outtakes in order to insure uniform stable conditions. This means that one large flue may be used for stables of at least 50 cows capacity and probably for more. Outtake flues should be so located that the air entering them is from the warmest part of the floor of the stable; they should be so placed that they can be built as high as the barn permits, and they should not obstruct the stable passages nor interfere with the handling of hay in the loft. Except for these requirements there seem to be no restrictions as to the location of outtakes.

The opinion is expressed, however, that the problem of designing intake passages is far from solved.

Data on outtake flue areas and sizes are tabulated.

Investigation of warm-air furnaces and heating systems, IV, A. C. Willard, A. P. Kratz, and V. S. Day (*Ill. Univ., Engin. Expt. Sta. Bul. 189* (*1929*), *pp. 116, figs. 49*).—This is the sixth of a series of reports of studies on warm-air furnaces (E. S. R., 60, p. 882). It deals entirely with the work accomplished in a specially designed research residence.

A comparison of the performance of a furnace in the laboratory with that of the same furnace in the research residence showed that the plant in the residence operated at lower capacity, efficiency, and register air temperature than did the laboratory plant. Less heat was given up to the recirculating air in the residence than in the laboratory plant. The temperature of the flue gases leaving the furnace in the former plant was also found to have been 85° F., or approximately 15 per cent higher than in the latter, at a 6-lb combustion rate. The deficiency of the plant in the research residence resulted in a reduction in temperature of the air emerging from the registers and a reduction in the quantity of air flowing. The combined effect amounted to a 20 per cent reduction in capacity. The reduction in temperature amounted to approximately 6° at the register, at a combustion rate of 6 lbs.

The data also showed that at any given rate of combustion in the furnace the air will be delivered at three floor levels at three different temperatures. It appears, therefore, that a system may not be designed to operate at the same temperature at all three floors.

Tests of the general performance of the residence heating plant showed that with soft coal in zero weather there was a flue loss at the furnace of 39 per cent of the heat of the fuel. About 26 per cent was finally lost from the top of the chimney. With hard coal the flue gas losses in zero weather at the furnace represented only 21 per cent of the heat of the fuel, and only 8 per cent was finally lost from the top of the chimney. When hard coal was fired the overall efficiency ranged from 92 to 97 per cent, averaging 95 per cent for average weather. With soft coal the overall efficiency averaged 75 per cent.

It was also found that exactly three-fourths of the heat available at the bonnet was delivered at the registers. This loss of 25 per cent between furnace and registers has the effect of reducing the efficiency of the system as a whole. With either hard or soft coal the indirect heat exceeded in amount the heat delivered at the registers.

A comparison of six cold-air recirculating systems showed that in general, somewhat better room temperature conditions may be obtained by returning the air from positions near the cold walls. Friction and turbulence in elaborate return-duct systems retard the flow of air and may seriously reduce furnace efficiency and lessen the advantages of such a design. The cross-sectional duct area is not the only measure of effectiveness. Friction and turbulence may operate to make the air flow out of all proportion to the duct areas.

A study of the effect of sunshine and wind on heating conditions showed that in coldest weather sunshine on the roof resulted in a 30° increase in the temperature of the roof, and an 8° increase in temperature of the gable spaces. In mild weather (20° indoor-outdoor difference) sunshine increased the roof temperature over 50° and increased the gable-space temperature about 12°. Only in extremely cold weather was the flow of heat outward through the roof when the sun was shining, and for weather warmer than 17.5° (indoor-outdoor difference 52.5°) the flow of heat was inward through the roof when the sun was shining. The flow of heat during periods of no sunshine was outward, the gable spaces being at higher temperature than the roof surfaces. In very cold weather this loss of heat was accentuated by a wide difference between the two temperatures.

A comparison of temperatures in the attic spaces in which an insulating blanket was laid over the joists with those recorded when no blanket was used showed that in coldest weather the use of the insulating material resulted in a reduction of 5 or 6° in the attic temperature. This reduction indicates that the heat transmission through the ceiling and insulating blanket was less than through the ceiling alone. It also indicates that the temperature difference through the insulated ceiling was greater than through the uninsulated one, a condition which must be taken into account in estimating the value of insulation materials.

A test of fuel consumption and economy with six varieties of solid fuel showed that Pocahontas coal possessed the greatest number of economical characteristics, such as least tonnage, least ash handling, and least cost. Soft coal, having the lowest unit price, was not the cheapest coal for the season, and required the greatest tonnage. This fuel, though unsatisfactory from the standpoint of smoke, soot, ashes, and low thermal efficiency, has the advantage of quick ignition with rapid acceleration of the fire. No one chemical or physical characteristic of the fuels alone controls the consumption. The results also showed that tonnage varies directly as the product of ash and volatile matter divided by the heat value.

The results of a large number of other tests of a detail nature are also reported.

RURAL ECONOMICS AND SOCIOLOGY

Agricultural economics, G. O'Brien (*London and New York: Longmans, Green & Co., 1929, pp. VIII+195*).—This book is based on lectures in the Albert Agricultural College, Glasnevin, Ireland. Agricultural economics is described as the science of agricultural prices, and the author distinguishes it from rural sociology, land economics, studies of the relation between food resources and world population, and farm management.

The three chapters deal with (1) the prices of agricultural products in general; (2) the prices of particular agricultural products, including sections and subsections on demand, inelasticity of supply, diminishing returns, costs and costing, the unit of production, costs of the factors of production, and costs of marketing; and (3) the methods by means of which public interference may influence prices, including sections on State assistance to the science of agriculture, costings research, regulation of the size of farms, reduction of the cost of the factors of production, research on marketing, reduction of cost of marketing functions, orderly marketing, widening the market, protective agricultural policies, and international assistance of agriculture.

Distribution of the agricultural income is not discussed.

[Papers presented at the nineteenth annual meeting of the American Farm Economic Association] (*Jour. Farm Econ., 11 (1929), No. 2, pp. 193–329, figs. 13*).—Included are papers and discussions thereon presented at the meeting at Chicago, Ill., December, 1928, as follows: A Statistical Examination of the Problem of Handling Annual Surpluses of Non-Perishable Farm Products, by M. Ezekiel (pp. 193–226); Prospective Displacement of the Independent Family Farm by Large Farms or Estate Management, and the Socio-Economic Consequences, by C. L. Holmes (pp. 227–247); Economic Aspects of the Administration of Groups of Farms under Northern Conditions, by E. C. Young, with discussion by O. G. Lloyd (pp. 248–265); Issues Involved in the Readjustment of Farm Organization in the Cotton Belt, by J. D. Pope, with discussions by R. J. Saville and O. M. Johnson (pp. 266–283); Direct Packer Buying in the Marketing of Livestock, by P. L. Miller, with discussions by G. F. Henning,

R. C. Ashby, and H. B. Price (pp. 284–312); and Problems in the Location of Country Milk Plants, by L. Spencer, with discussion by H. Metzger (pp. 313–329).

A decade of rural progress, edited by B. Y. LANDIS and N. T. FRAME (*Natl. Country Life Conf. Proc., 10–11 (1927–1928), pp. 161*).—This volume is based upon the proceedings of the Tenth National Country Life Conference, held at East Lansing, Mich., August 1–4, 1927, and the Eleventh Conference, held at Urbana, Ill., June 19–21, 1928, and the reports of committees to the American Country Life Association.

The following addresses are included: The Issues of Farm Life, by K. L. Butterfield (pp. 7–10); Suggestions Regarding Emphases, by L. H. Bailey (pp. 11–13); Some Aspects of the Agricultural Situation, by W. M. Jardine (pp. 14–17); Science in Rural Human Relationships, by C. J. Galpin (pp. 18–21); Rural Electrification, by F. D. Paine (pp. 43–45); The Work of the Major Protestant Bodies, by M. Dana (pp. 58–62); The Catholic Experience, by E. V. O'Hara (p. 62); Religion and the Jewish Farmer, by G. Davidson (pp. 63, 64); Religion in McHenry County, Illinois, by C. R. Hutchinson (pp. 65–69); Tax Legislation, by C. L. Stewart (pp. 94–103); Benefits from Taxation, by M. H. Hunter (pp. 104–110); Our Agricultural Income, by J. I. Falconer (pp. 113–116); Farm Income and Standard of Life, by H. C. Taylor (pp. 117–122); Factors Influencing Farmers' Incomes, by J. D. Black (pp. 123–129); Relation of Income to Successful Farming—The Master Farmer, by O. G. Lloyd (pp. 130–134); The Relation of the Standard of Life to Success in Farming, by E. L. Kirkpatrick (pp. 135–140); The American Country Life Movement, by K. L. Butterfield (pp. 143–145); An Interpretation of the Tenth National Country Life Conference, by A. R. Mann (pp. 146–151); and Past Issues and Future Hopes, by C. C. Taylor (pp. 152–156).

The following reports of committees are given: Rural Health and Sanitation, by W. A. Brown et al. (pp. 25–35); The Farm Home, by V. B. Schuttler et al. (pp. 36–40); The Rural Home, by Mrs. C. A. Steele (pp. 41, 42); Rural Education: A Decade of Progress in Rural School Administration by J. E. Butterworth (pp. 46–49), Progress in Certificating Teachers through State Law and Regulations by K. M. Cook (pp. 49–51), A Decade of Progress in Rural School Supervision by M. S. Pittman (pp. 51, 52), A Decade of Progress in Rural Teacher Training by V. McGuffey (pp. 52–54), and Revision of the Rural School Curriculum by H. H. Heyl (pp. 54–57); Rural Social Work, by L. A. Ramsdell et al. (pp. 70–77); Rural Recreation and Social Life, by H. D. Meyer et al. (pp. 78–86); Communication and Transportation, by T. A. Coleman et al. (pp. 87–91); and Rural Government, by E. H. Ryder et al., (pp. 92, 93).

Lists of officers, directors, representatives, and committees for 1928 are also included.

Facts and problems of farm credit in Craighead County, Arkansas, A. N. MOORE and C. O. BRANNEN (*Arkansas Sta. Bul. 233 (1929), pp. 46, figs. 5*).—This bulletin is based on data for 1926 obtained from 140 farmers, 7 bankers, and 14 credit merchants in a township in the eastern part of Craighead County, a county the population of which is almost exclusively white. The farm records covered one-fifth of the farms in the township, and about 69 per cent were secured from tenants or croppers, this being the average percentage in the county in 1924. In 1926, 58 per cent of the crop land of the farmers interviewed was in cotton and 77 per cent of their total sales were cotton.

Tables and graphs are included and discussed showing for the owners and tenants the number using and the average amount of short-term, cash, and merchant credit used, the seasonal use of credit, purposes for which different

kinds of credit were used, security and sources of short-term credit, amount of short-term credit paid and unpaid in 1926, number using merchant credit, rates of interest on different kinds of credit, and other data. Some data are given regarding farm mortgage indebtedness and analyzed as to source, rates of interest, commissions paid, payments made, etc. The credit policies of banks and merchants, risks and losses, variations in needs for credit, advantages and disadvantages of the different kinds of credit, situation of local banks and other credit institutions, and other features of the credit situation are discussed.

Of the 42 owners interviewed 33 used short-term credit, 27 cash credit, and 22 merchant credit in 1926, the average amounts being $387, $311, and $198, respectively. Of the 91 tenants, 86 used short-term, 40 cash, and 63 merchant credit, the average amounts being $258, $229, and $206, respectively. Of the total short-term credit, 67 per cent, 4 per cent, and 29 per cent were used for living expenses, purchases of livestock, and tools and miscellaneous farm expenses, respectively; of the merchant credit 80, 0, and 20 per cent, respectively; and of the cash credit, 54, 7, and 39 per cent, respectively. One-fourth of the total credit was on open account or plain notes, 10 per cent on indorsed credit with or without crop or chattel mortgage, and 65 per cent unindorsed but secured. The average costs of credit were for cash credit 8.7 per cent for both owners and tenants, merchant credit 13.5 per cent for owners and 18.9 per cent for tenants, and short-term credit 10.3 per cent for owners and 14.6 per cent for tenants.

The study showed that an average reserve of about $200 would have eliminated the carry-over of short-term credit from 1926 to 1927, and an average saving of $204 available at the beginning of 1926 would have enabled the farmers to dispense with expensive merchant credit.

Farm organization and management in typical upland sections of Arkansas, J. A. Dickey (*Arkansas Sta. Bul. 235 (1929), pp. 91, figs. 9*).—Analysis is made by the multiple and partial correlation methods of 970 farm records for 1924, about two-thirds of which were obtained in Faulkner County and the remainder in four other counties. The labor incomes on the farms varied from —$200 or less to $0 on 16 per cent of the farms, from $1 to $400 on 59 per cent, $401 to $1,000 on 21 per cent, and over $1,000 on 4 per cent.

Tables are included showing, by tenure and size of farms in groups which are multiples of 40 acres and over 260 acres, the utilization of land; yields and coefficients of variability of yields per acre of cotton, corn, and hay; crop indexes and coefficients of variability of crop indexes; disposition of crops; use of land and livestock; number and kinds of livestock per farm and per 100 acres; value of farm assets per farm and per acre; receipts per farm and per acre by sources; expenses by items; and labor income. Other tables show by size groups coefficients of variation in land utilization, total and by tenure groups; utilization of pasture land; use of fertilizer; relation of value of labor to other costs; efficiency of use of labor; number of productive labor units per man equivalent; number of farm implements; efficiency in the use of horses and machinery; size of fields in cotton, corn, and hay; use of labor by tenure groups; coefficients of variation in number of farm animals per farm; percentage that net income was of total indebtedness by tenure groups; value and net returns of livestock and livestock products; factors of organization and management on the 25 per cent of the farms making the highest labor income; disposition of livestock and livestock products; and value of woods and timber products; and by tenure groups the fertilizer used per acre of cotton.

Among other findings were the following: The larger the farms the greater was the percentage of land in extensive crops and the smaller the percentage

in intensive crops. Livestock enabled the size of business to be increased and was directly related to labor income, being a negative factor on small farms and a positive factor on large farms. Lands reserved in woods justified the investment and contributed materially to receipts on the larger farms. At least 400 productive work units per man equivalent were necessary for a labor income equal to the average for all the farms, and an average of 550 units was required for an income of $500.

The acres operated per $100 worth of labor increased from 8 on 40-acre farms to 38 on 260-acre farms, and the number of acres of crops per $100 worth of labor increased from 5 on 40-acre farms to 12 on 200- and 240-acre farms. The smaller farms have more nearly reached the point of diminishing returns on all elements of production, while on the larger farms practically any enterprise can be increased without becoming unprofitable. The larger incomes of the larger farms were the result of economy and efficiency of operation and of the lesser percentage of crops consumed.

Other factors remaining constant, each point of increase in the crop index increased labor income $3.84. Each 10 per cent increase in the size of farm gave a 2 per cent increase in the amount of cotton per man equivalent. The substitution of horses and equipment was a striking feature of progress on the larger farms. Tenure had but little effect on the organization and labor income. The best paying combination of enterprises was one with an amount of cotton, the last unit of which just paid its cost, plus a like amount of production from other sources. If all farms in each size group could have been organized and managed on the basis of the most successful farms in the group, farm expenses would have been approximately 15 per cent higher, but the labor income would have been 45 per cent higher.

Systems of farming for the Black Waxy Prairie Belt of Texas, L. P. Gabbard, J. B. Hutson, and T. L. Gaston, Jr. (*Texas Sta. Bul. 395 (1929), pp. 57, figs. 9*).—This bulletin outlines several systems of farming, each for 50-, 100-, 150-, and 200-acre farms. The systems vary in organization from farms with one-eighth to all of the acreage of cultivated land devoted to cotton. Feed crops for livestock are substituted if the percentage of land in cotton is reduced.

Tables are given showing for the different-sized farms and systems the values of land, buildings, machinery, and livestock, the number of work stock and different kinds of livestock, the acreages of different crops, hours of man labor on crops and on livestock, hours of horse labor on crops, receipts, value of products used on the farm, expenses, and net returns.

The conclusions reached are based upon a survey made in 1922 of the prevailing economic conditions and covering 500 farms (E. S. R., 53, p. 893); detailed studies of 23 selected farms in 1925, 26 farms in 1926, and 28 farms in 1927; experimental data on yields of cotton and other crops in different rotations secured by the Temple Substation; and a study of the prevailing prices in the section during recent years. The work was done in cooperation with the U. S. D. A. Bureau of Agricultural Economics.

The net returns from the several systems were lowest on the farms having all cultivated land in cotton and increased with each decrease in the percentage of land in cotton up to the point where about 25 per cent of the cultivated land was in cotton. The variations within the range of 25 to 50 per cent were not great.

Ranch organization and operation in the northern Great Plains region, 1927 (*[U. S. Dept. Agr., Bur. Agr. Econ., 1928], pp. [22]*).—This is a mimeographed preliminary report on the project on ranch organization and operation in the northern Great Plains region carried on by the State agricultural

experiment stations of Montana, Wyoming, South Dakota, and North Dakota, and the Bureaus of Agricultural Economics and Animal Industry, U. S. D. A. It is based upon reports from 49 ranches for the year 1927.

Of the 49 ranches, 9 made over 15 per cent on investment; 15 from 10 to 15 per cent; 15 from 5 to 10 per cent; 8 less than 5 per cent, and 2 were operated at a loss. Ranch income; hay, crop, and range land requirements; control of land; the combination of range cattle and other sources of income; calf crop; winter feeding; grazing crops by livestock; and the age at which to sell cattle are discussed.

Details of the organization and operation in 1927 of 3 ranches illustrative of the prevalent types of organization in the region are given, with suggestions for improvements.

Cost and efficiency in producing alfalfa hay in Oregon, H. E. SELBY (*Oregon Sta. Bul. 241 (1928), pp. 72, figs. 26*).—This bulletin presents information on the costs of producing alfalfa hay in Oregon, the factors affecting the costs, and the methods of reducing different costs. It is based chiefly on 632 records obtained in 1925, 1926, and 1927 from representative farms in the Malheur, Baker-Union, Umatilla, Deschutes, Klamath, and Rogue River areas. Tables are included showing for each area and for the six areas the average costs per acre and per ton by items, the average cash and noncash costs per acre, and the average costs per acre and per ton for each year.

Harvesting methods and equipment, other factors affecting efficiency in haying, yield and factors affecting it, and the costs of establishing a stand of alfalfa are discussed, with tables and charts showing the effects of different items and factors on yields and costs. Other tables are included and discussed showing the man labor and horse work used in different areas, the acreage of alfalfa and other crops, number of livestock of different kinds, investment per farm and per acre of alfalfa, percentage of alfalfa sold and fed, and the prices received per ton in the different areas.

The appendixes include supplementary and detailed tables, and tables showing costs by items of producing alfalfa hay in the Willamette Valley and of alfalfa hay and wild hay in the Harney Valley.

The average cost of production for the six areas was $27.06 per acre and $7.96 per ton. The average cost of harvesting was $3.42 per ton using wagons, and $2.94 using buck rakes. Of the total average cost, cash items constituted 41 per cent, labor of operator and family 22 per cent, depreciation 9 per cent, and interest 28 per cent. The average cost in each area varied but little from year to year, but there was considerable variation both between different farms in the same year and the same farms in different years. The cost of production per ton decreased from an average of $15.34 for yields of less than 2 tons per acre to $5.78 for yields of 6 tons or over.

An economic study of the production of tomatoes in Maryland, W. P. WALKER (*Maryland Sta. Bul. 304 (1929), pp. 177–238, figs. 14*).—The data upon which this report is based were obtained by the survey method from 13, 26, and 40 farms in Harford County, having a total of 99, 121, and 209 acres in tomatoes in the years 1925, 1926, and 1927, respectively, and from 83, 169, and 222 farms in the Eastern Shore area, having a total acreage of 654, 1,058, and 1,440 acres in the respective years.

Tables and graphs are included showing for each year and the average or total for the period for the two areas (1) the average costs of growing and harvesting, total and by items, yields per acre, number of farms producing tomatoes at different costs, net income per acre, comparison of contract and open market selling, and relation between acreage, yield per acre, cost of grow-

ing per acre, and total cost per ton, and (2) by counties the total average cost of production per ton, the yields and net income per acre, relationship between yields, costs, and net income (1926 and 1927), and comparison of contract and open market prices per ton. A statistical analysis by counties and discussion is also included of the prevailing practices, 1926 and 1927, as regards seed, plants, varieties, preparation of soil, fertilizers, manure, lime, planting, cultivating, spraying, harvesting, crop rotations, and tenancy, and also as regards man, horse, and tractor requirements for each operation in growing and harvesting and the material requirements per acre up to harvesting.

During the three years the average cost of growing and harvesting varied from $8.91 to $13.30, averaging $10.28, per ton in Harford County and from $10.16 to $17.32, averaging $11.87, for the Eastern Shore counties. Of the average costs for all farms for the three years, the percentages for the two areas were semifixed growing costs (seed, plants, machinery, and taxes), 10.45 and 13.43; variable growing costs (preparing soil, planting, cultivating, and spraying), 24.83 and 24.74; optional growing costs (fertilizer, manure, and lime), 26.29 and 32.70; and harvesting costs, 38.43 and 30.13, respectively. Individual costs per ton varied from $5.31 to $88.76, that for 362 of the 552 farms being less than the price received per ton, which averaged $14.97 for contract sales and $15.55 for open-market sales.

Recommendations are made as to means of increasing profits.

An economic study of the production of sweet corn and peas in Maryland, S. H. DeVault and W. P. Walker (*Maryland Sta. Bul. 305 (1929), pp. 239–329, figs. 22*).—This bulletin follows the same plan as that noted above, and the data were obtained in the same way in 1925, 1926, and 1927, respectively, for sweet corn from 34 farms (608 acres), 55 farms (914 acres), and 75 farms (1,024) acres in the North Central area of the State, and 20 farms (211 acres), 41 farms (604 acres), and 28 farms (423 acres) in the Eastern Shore area; and for peas 21 farms (142 acres), 24 farms (224 acres), and 26 farms (243 acres) in Garrett County, 10 farms (84 acres), 27 farms (172 acres), and 19 farms (90 acres) in the North Central area of the State, and 11 farms (135 acres), 54 farms (516 acres), and 86 farms (633 acres) in the Eastern Shore area.

The average costs of production of sweet corn per ton for the three years varied from $11.29 to $16.55, aversging $13.94, in the North Central area, and from $11.02 to $11.91, averaging $11.28, in the Eastern Shore area. Of the average costs for the three years for all farms, 10.84 per cent was semifixed growing costs, 36.12 per cent variable growing costs, and 33.81 optional growing costs, and 19.23 harvesting costs in the North Central area. The percentages for the Eastern Shore area were 10.11, 30.85, 37.66, and 21.38, respectively. The cost per ton on individual farms varied from $4.62 to $112.34. The average net income was $1.23 per ton. Forty-nine per cent of the farms, growing 51 per cent of the acreage, produced corn at less than the average price received, $13.67 per ton.

For peas the average cost of production per ton for the three years varied from $39.40 to $42.76, averaging $41.36, in Garrett County; from $32.25 to $45.31, averaging $39.74, in the North Central area; and from $35.41 to $53.29, averaging $41.00, in the Eastern Shore area. Of the averages for all farms for the three years, the percentages spent for semifixed, variable, and optional growing costs, and harvesting costs were 40.78, 13.28, 26.23, and 19.71, respectively, for Garrett County; 42.52, 16.82, 17.34, and 23.30 for the North Central area; and 46.08, 13.62, 24.76, and 15.54 for the Eastern Shore area. The 3-year average cost for all farms was $40.98 per ton. The cost per ton on individual farms

varied from $18.80 to $12,931. The average price received was $60.74 per ton, and 78 per cent of the farms, growing 84 per cent of the acreage, produced peas at a profit.

Merchandising fruits and vegetables, W. A. SHERMAN (*Chicago and London: A. W. Shaw Co., 1928, pp. XV+499*).—This volume outlines the history of and traces the developments in the marketing of fruits and vegetables in chapters as follows: The background of our present trade; effects of industrial expansion and city growth; artificial ice brings revolution; hazards of the new industry; how the handler became banker; economic differences between the fruit and vegetable industries; the influence of cooperative organization; marketing through factories; history, extent, and future of canning; when Government entered the field—1913; the status of the industry in 1913; the evolution of standardization, terminal market inspection service, shipping point inspection, the national market news service, transportation service, and the national distributor; specialized marketing functions; creating demand; market psychology; psychological influence on price levels; the problem of distribution; delivered sales v. shipping-point sales, why the near-by producer survives; the problem of surpluses; and evolution in trade relationships.

Peanuts, T. O. MARVIN ET AL. (*Washington: U. S. Tariff Comn., 1929, pp. VIII+88, figs. 7*).—This is a report of the U. S. Tariff Commission to the President of the United States on the differences in costs of production of peanuts, not shelled and shelled, in the United States and in the principal competing country, China. The appendix includes the proclamation of the President, January 19, 1929, increasing the duty on peanuts, not shelled, from 3 to 4.25 cts. per pound, and on peanuts, shelled, from 4 to 6 cts. per pound.

Eggs and egg products, T. O. MARVIN ET AL. (*Washington: U. S. Tariff Comn., 1929, pp. VI+36*).—This is a report of the U. S. Tariff Commission to the President of the United States on the differences in costs of production of eggs and egg products in the United States and in the principal competing country, China. The appendix includes the proclamation of the President, February 20, 1929, increasing the duty on whole eggs, egg yolk, and egg albumin, frozen or otherwise prepared or preserved, and not specially provided for, from 6 to 7.5 cts. per pound.

Charts relating to the 1929 agricultural outlook, I, II (*U. S. Dept. Agr., Bur. Agr. Econ., 1929, pts. 1, pp. [5]+17, pls. 67; 2, pp. [4]+13, pls. 44*).—These sets of charts are selected to aid extension workers in presenting the agricultural outlook for 1929 (E. S. R., 61, p. 82).

Part 1, on farm crops, includes charts on the acreage, yield, production, exports, imports, prices, shipments, etc., of corn, oats, wheat, flax, rye, barley, cotton, tobacco, potatoes, peaches, apples, and sugar; and shows index numbers of prices received and paid by farmers, 1910–1928, indexes of pay rolls in manufacturing industries and industrial production, 1921–1928, and the supply of farm labor and industrial employment, 1919–1928.

Part 2, on livestock and products, includes charts showing numbers, receipts at important markets, prices, factors affecting prices, etc., for beef cattle; hogs; sheep, lambs, and wool; horses and mules; dairy cattle and products; and poultry and eggs.

A brief interpretation, mimeographed, covering the principal facts brought out by each chart is included.

Crops and markets, [June, 1929] (*U. S. Dept. Agr., Crops and Markets, 6 (1929), No. 6, pp. 193–232, figs. 3*).—Included are tables, graphs, notes, reports, and summaries of the usual types and tables showing the acreage per farm, yield per acre, cost of production by items, value per acre of by-products, and

net cost per acre and per bushel of corn, wheat, and oats by geographical divisions, 1928, and the acreage of cotton, yield of lint per acre, cost of production by items, value of cottonseed per acre, and net cost of lint per acre and per pound, 1928, by yield groups. Data as to the source of chickens raised, mortality of chickens, and number of hens and pullets and eggs laid per farm flock are also reported.

Services of rural trade centers in distribution of farm supplies, H. B. PRICE and C. R. HOFFER (*Minnesota Sta. Bul. 249 (1928), pp. 55, figs. 4*).—This bulletin presents an analysis of the organization of the distribution of supplies and services among the farm population of Minnesota, and is based chiefly upon a survey made in 1922 in cooperation with the U. S. D. A. Bureau of Agricultural Economics, of 12 towns ranging in population from 388 to 11,089 people.

Tables are included and analyzed showing for the 12 towns the number of stores of different types, the sales per store per 1,000 population, percentage of total amount spent in different trade agencies, grades of merchandise sold, average amounts spent for different kinds of advertising, number of merchants using different methods of advertising, and the amounts charged to customers' accounts; and for the different types of stores the average volume of sales, value of stock carried, stock turn and gross mark-up, grades of merchandise, amounts spent for and kinds of advertising used, methods, interior appearance of stores, percentage of merchants having widening group contacts, qualifications, experiences, etc., of managers, business methods, and amounts and percentages of credit business.

General, drug, and hardware stores were found in all of the 12 towns; men's clothing, jewelry, furniture, and variety stores only in towns of approximately 1,000 or over; and ladies' ready-to-wear stores only in towns of 2,000 or more.

Analysis of data for 603 towns in Minnesota with population of less than 11,500 showed the minimum size of towns for different types of stores to be as follows: Drug stores, 500; furniture, grocery, jewelry, and men's clothing, 1,000; shoe stores, 2,500; ladies' ready-to-wear and dry goods and variety stores, 3,000; and general and hardware stores, no minimum. Of the total sales in the 12 towns the percentages for the different types of stores were: General stores, 38.5; hardware, 16.9; grocery, 10.6; ladies' ready-to-wear, 9.1; men's clothing, 8.0; drug, 5.4; furniture, 3.5; shoe, 3.1; variety, 2.9; and jewelry stores, 1.5.

Four methods of attacking the problem of the merchandising relationship between farmers and their trade centers are outlined. The gross cash income and classes of expenditures of Minnesota farmers and consumers' cooperation in the State are discussed briefly.

FOODS—HUMAN NUTRITION

Food consumption of farm families, H. MCKAY (*Ohio Sta. Bul. 433 (1929), pp. 34, figs. 2*).—This is the complete report of an investigation previously noted from another source (E. S. R., 61, p. 489). In addition to data summarized in the earlier report, there is a discussion of the money cost of the foods consumed. In determining this the prices recorded for foods produced on the farm and used in the family were estimated from the prices for which they could have been sold checked against price indexes for the year. The average cost of the nutrients as thus calculated was $1.60 per family, or 41 cts. per adult male unit per day. In terms of the principal food groups, 16.62 per cent of the total expenditure was for milk, cream, and cheese; 25.8 for fruits and vegetables; 25.17 for meat, fish, and poultry; 11.05 for bread and cereals; and 21.46 per cent

for fats, sugars, and other groceries. In comparison with the Sherman standards of at least as much for each of the groups milk and dairy products, and fruit and vegetables as for the meat group, the Ohio families studied were above the standard for fruits and vegetables and only slightly below for milk and dairy products. The fact, however, that the average diet was barely adequate in its iron content is thought to indicate the need for an even larger expenditure for fruits and vegetables. "It would seem that the value of milk and of fruits and vegetables should be still further stressed in educational work designed to influence rural families in their food selection."

Chemical analyses of thirty-seven oriental foods, H. E. Sherman and T. C. Wang (*Philippine Jour. Sci., 38 (1929), No. 1, pp. 69–79*), *pls. 7*).—Proximate analyses are reported for 37 foods, bought in the native markets of Peking, China. The foods, most of which were of vegetable origin and unknown outside the Orient, are described with, as far as possible, their botanical classification, Chinese characters, Romanized local names in the Peking dialect, and for foods found also in the Philippine Islands the names in the Tagalog dialect.

The soybean as a national food, V. Ducceschi (*La Soja e l'Alimentazione Nazionale. Milan: Francesco Vallardi, 1928, pp. X+246, figs. 9*).—This monograph, written from the standpoint of the promotion of soybean cultivation in Italy, deals with its culture, the chemical composition and nutritive value of the seed, its utilization as oil, flour, alimentary paste, and other products, its medical application particularly in diabetes, and its economic value. The final chapter consists of arguments in favor of the more extensive cultivation of the soybean in Italy. An extensive bibliography is appended.

Relation of hydrogen-ion concentration and buffer value to the baking quality of flour, Part I, E. A. Fisher and P. Halton (*Cereal Chem., 6 (1929), No. 1, pp. 18–33, figs. 4*).—Sources of error in the early studies of Jessen-Hansen on the effect of H-ion concentration on the baking qualities of flour (E. S. R., 27, p. 166) are pointed out, and a repetition of the work under more rigidly controlled conditions is reported, with the conclusion that for the two flours studied, a fine English patent and a straight run (72 per cent extraction) Canadian, H-ion concentration is of little importance as far as the loaf quality is concerned.

With the patent flour the fermentation was hastened slightly by increasing the H-ion concentration of the dough, but this was not observed with the straight run flour. Large increases in the H-ion concentration (a fall of 0.8 in pH) tended to increase the toughness of the dough and to give a more pronounced flavor to the loaf. It is thought that many of the chemical and colloidal changes taking place in fermenting dough are of far greater importance than any slight changes in H-ion concentration.

Effect of dry skimmilk on the fermentation and hydrogen-ion concentration of doughs, J. L. St. John and C. H. Bailey (*Cereal Chem., 6 (1929), No. 1, pp. 51–59, figs. 4*).—The first part of this study involved measurements of the relative rate of fermentation in doughs prepared with the addition of reconstituted skim milk powder and fluid skim milk, each in the proportion, in terms of milk solids, of 2 and 6 per cent of the ingredients of a milk-free formula. The method described by Bailey and Johnson (E. S. R., 53, p. 410) was used with a slight modification in the dough container.

The fluid milk had but little effect upon fermentation, but the dry skim milk increased the production of gaseous carbon dioxide in the dough and also to some extent the loss of carbon dioxide from the dough. The rate of increase in the volume of the doughs was practically the same with or without the dry skim milk.

In the second part dry skim milk was added to flour in varying amounts up to 6 gm. per 100, and the mixture was fermented at 28° C. Two lots of flour were used, one with a single brand and the other with two brands of a spray-process dry skim milk. As judged by the pH values obtained at hourly intervals, the dry skim milk showed appreciable buffer action. It is suggested that the greater stability of doughs containing dry skim milk may be the consequence of the slower change in H-ion concentration.

Milk consumption and the growth of school children, G. Leighton and M. L. Clark (*Lancet [London], 1929, I, No. 1, pp. 40–43; also in Brit. Med. Jour., No. 3548 (1929), pp. 23–25*).—A continuation along the same lines of the investigation reported by Orr (E. S. R., 60, p. 192) has given even better results with the same children than those previously reported in the use of either whole or skim milk as a supplementary school lunch. In the repeated tests the average increase in height in the milk-fed groups of all ages combined was 1.21 per cent, and in weight 3.75 per cent above the figures for the first test. In most groups the differences in gains in height and weight between the whole milk and separated milk groups were not statistically significant, but in the 6-year-old group whole milk was significantly better than separated milk as judged by both weight and height. In every case the gains on the whole and separated milk were better than in the crackers or control groups, and in nearly every case the difference between the crackers and control groups was insignificant.

The virtues of milk (*Lancet [London], 1929, I, No. 1, pp. 28, 29*).—In this editorial comment on the report of Leighton and Clark (noted above), the suggestion is made that in the mining areas of South Wales and Durham, where it is of importance that the funds collected for relief in the food situation should be spent wisely and economically, protection against most forms of undernutrition might be secured by distributing a basal ration of porridge, whole wheat bread, 1 pint of separated milk, and 1 oz. of margarine containing vitamin A per person per day.

A comparative study of certified and pasteurized milk in infant feeding, M. S. Lewis (*Arch. Ped., 46 (1929), No. 2, pp. 85–98, figs. 7*).—The subjects of this study were obtained from the Tennessee Children's Home Finding Society, and were under observation from March, 1925, to March, 1927. Of the 234 infants, 122 received whole certified milk or suitable modifications and 112 pasteurized milk or modifications. Both forms of milk were boiled for two minutes. The subjects were classified in three age groups and compared for average weight and height at different periods, general development, number of gastrointestinal upsets and number of stools, and mortality.

As judged by the average growth curves, the subjects on the certified milk showed greater gains, particularly in the first period, from birth to three months of age. In other respects the certified milk groups also made the better showing. The occurrence of rickets was less marked and the disease was in lighter form, there were fewer cases of diarrhea, and the mortality was lower.

In commenting upon these results it is emphasized that the certified milk was of unusually high quality.

A study of the routine use of powdered whole milk in infant feeding, L. O. Ashton, O. L. Stringfield, and C. W. Martin (*Arch. Ped., 46 (1929), No. 2, pp. 75–84, fig. 1*).—This contribution from the pediatric department of the New York Post-Graduate Hospital includes a brief review of the literature on the use of dried whole milk for infant feeding, a description of the method of manufacturing the milk used in the present study, Klim, a report from J. M. Sherman of its bacterial analysis, and a summary of the results obtained in its

use for a period of one year in the feeding of 100 babies. Formulas suited to the age were used, and the milk feeding was supplemented with orange juice and cod-liver oil.

The average weekly gains in weight of infants under six months was 6.75 oz. and of those over six months 4.75 oz. In every case the milk was taken as well as whole milk. The stools were on the whole slightly softer than those of infants fed on boiled milk mixtures. The fat appeared to be digested better than the fat in fresh milk modifications and no case of protein indigestion was noted. Seven cases of diarrhea developed, two of which were associated with an upper respiratory infection, but only one of a severe type.

It is concluded that modifications of powdered whole milk can be used as a routine material in infant feeding in place of fresh whole milk modifications.

A list of 18 literature references is appended.

An experimental study of the use of unsweetened evaporated milk for the preparation of infant feeding formulas, McK. Marriott and L. Schoenthal (*Arch. Ped., 46 (1929), No. 3, pp. 135–148*).—In this report from the department of pediatrics, Washington University School of Medicine and the St. Louis Children's Hospital, the literature on the characteristics of evaporated milk is reviewed, and the results are reported of a study of its value in infant feeding. The evaporated milk series included 570 newly-born infants, 107 infants in dispensary and private practice, and 75 sick infants in a hospital. Among the entire number were 11 premature infants. A comparison was made with 670 infants breast-fed or fed on other forms of milk modifications. Both sweet and acid milk modifications were used, the latter being prepared as described by Marriott (E. S. R., 57, p. 893).

Of the newly-born infants who were fed exclusively on evaporated milk preparations 92.8 per cent, and of those whose food consisted chiefly of the evaporated milk 80 per cent, regained their birth weight in 14 days, while in the control series of 526 newly-born infants fed exclusively on breast milk or given extra feedings of cow's milk modifications only 66 per cent regained their birth weight in 14 days. The evaporated milk mixtures were uniformly well digested and caused no gastric disturbances.

In the second series of well infants the average length of feeding was 130 days as compared with 120 days for the control group. The average daily gains in weight of the babies fed evaporated milk were exactly the same as of the controls, and in the resistance to infection and general development no differences were noted in the two groups.

The group of sick infants included many who were critically ill from various disorders. The average gain on the evaporated milk was somewhat better than that of the control group, but the weight differences in these groups were not considered of great significance on account of the many disturbing factors. Especially good clinical results were obtained with evaporated milk in case of infants suffering from diarrhea.

The feedings of the evaporated milk to the 11 premature infants were begun generally during the first few days of life and continued for an average length of 66 days. The average daily gain in weight was 22.5 gm. (0.79 oz.), while that of the 9 infants fed evaporated milk exclusively was 25.8 gm. (0.92 oz.). The weight at 10 months of one infant weighing only 4 lbs. at birth and receiving nothing but evaporated milk was 99.8 per cent of the average normal weight for the age.

The authors conclude that unsweetened evaporated milk is the full equivalent in nutritive value of pasteurized or boiled whole milk; that the continued use of it as a routine food for normal infants is unattended by nutritional dis-

turbances; and that in suitable modifications it is especially satisfactory for premature infants and for those suffering from nutritional or gastrointestinal disorders.

A list of 33 references to the literature is appended.

Influence of whole wheat upon hemoglobin regeneration in albino rats, M. S. Rose, E. McC. Vahlteich, and E. L. Bloomfield (*Soc. Expt. Biol. and Med. Proc., 26 (1929), No. 4, pp. 322, 323*).—As a part of a study of the place of whole-grain cereals in the diets of normal children, the authors have tested the value of whole wheat for hemoglobin regeneration in young rats rendered anemic by the exclusive feeding of fluid pasteurized milk from the time of weaning. When repeated hemoglobin determinations, made by the Newcomer method, had shown that the percentage of hemoglobin in the blood had fallen to about half the normal amount for the age, one-half of the rats were continued on milk alone and the other fed daily a supplement of 6 gm. of whole wheat containing 0.2 mg. of iron.

The control rats showed progressive lowering of hemoglobin, the value in 11 weeks falling to between 5.8 and 4.5 gm. per 100 cc. of blood. In the wheat-fed rats there was a sharp rise in hemoglobin, usually by the end of the first week. This was followed by a more gradual increase to values ranging between 15 and 19 gm. per 100 cc., figures well above normal.

Effect of an exclusive meat diet on chemical constituents of the blood, C. W. Lieb and E. Tolstoi (*Soc. Expt. Biol. and Med. Proc., 26 (1929), No. 4, pp. 324, 325*).—This preliminary report of an investigation of the effect on human beings of an exclusive meat diet of several months' duration deals only with the effect upon the kidneys and the changes in blood constituents. The subjects were two arctic explorers who had spent many years in the Arctic Circle, living for the greater part of the time exclusively on meat and fat. In the present investigation both ate nothing but meat, cooked and raw, each consuming enough to furnish from 120 to 130 gm. of protein and sufficient fat to total a daily caloric intake of from 2,200 to 2,800 calories. The experiment was continued for 11 months, blood samples being taken once a month.

The results are given only in summary as follows: "(1) Two healthy men living exclusively on meat for the past 11 months felt no untoward effects, maintained their weight, and were in excellent health. (2) We find no evidence of renal impairment. (3) The chemical composition of the blood is little affected, except for a slight increase in uric acid and a temporary lipemia. The latter occurred significantly and only after unusual amounts of fat were taken."

The effects on human beings of a twelve months' exclusive meat diet based on intensive clinical and laboratory studies on two arctic explorers living under average conditions in a New York climate, C. W. Lieb (*Jour. Amer. Med. Assoc., 93 (1929), No. 1, pp. 20–22*).—A general summary of the clinical and miscellaneous data obtained in the course of the investigation noted above.

Calcium, iron, and magnesium content of sixteen Chinese foods, H. E. Sherman and T. C. Wang (*Philippine Jour. Sci., 38 (1929), No. 1, pp. 81, 82*).—Data are reported on the content of calcium, iron, aluminum, and magnesium in the ash of 14 of the foods of the previous study (page 586) and two others. Soybeans, green beans, and mung beans were sprouted in distilled water for a comparison of their calcium content with that of the same materials sprouted in hydrant water. In all cases the sprouts in distilled water had a lower calcium content than the same variety of sprout grown in the very hard water of Peking.

On the presence of aluminum in plant and animal matter, L. Kahlenberg and J. O. Closs (*Science, 69 (1929), No. 1781, p. 186*).—This is a brief note

without experimental data, stating that the authors have checked the work of McCollum, Rask, and Becker (E. S. R., 59, p. 687) and find that they are in error in their conclusion that aluminum is not present in plant or animal matter. With the Hilger quartz prism spectrograph evidence was obtained of the presence of aluminum in a large number of materials of vegetable and animal origin.

Iodine in nutrition, J. B. ORR and I. LEITCH ([*Gt. Brit.*] *Med. Research Council, Spec. Rpt. Ser. No. 123* (*1929*), *pp. 108+VIII, figs. 2*).—This critical survey of the literature on the subject is presented under the following headings: Historical survey; the distribution of iodine in nature; the effect of iodine on plant metabolism; iodine metabolism in animals; effect of iodine administration on various organs and tissues other than thyroid; nature, distribution, and etiology of goiter; the use of iodine in the treatment and prevention of simple goiter; and iodine requirements.

Appendixes contain descriptions of the Kendall method for the estimation of iodine as modified by Kelly and Husband (E. S. R., 52, p. 613) and the Fellenberg method, as modified by Leitch and Henderson (E. S. R., 56, p. 312); tabulated data with literature references on the iodine content of foodstuffs and miscellaneous substances and of animal and human thyroids, and on the geographical distribution of simple goiter; and an extensive list of literature references.

The manganese in food-stuffs, C. NEWCOMB and G. SANKARAN (*Indian Jour. Med. Research, 16* (*1929*), *No. 3, pp. 788–798*).—The method used in this investigation consists essentially in ashing the material, disssolving the ash in dilute nitric acid, oxidizing the manganese to permanganate by ammonium persulfate, using silver nitrate to catalyze the reaction, and finally determining the amount of permanganate colorimetrically. A new feature of the method is the separation of the manganese from silica, which tends to adsorb it. This is done by fusing the ash with alkali carbonate, which converts the silica into soluble alkali silicate, diluting the solution, and pouring it directly into more than enough acid to neutralize it. Under these conditions the silicic acid is produced as a stable colloidal solution which does not interfere with the oxidation or subsequent colorimetric determination of the manganese. The technique, which is described in detail, is said to be capable of detecting as small amounts as 1 part of manganese in 1,000,000 of the food material.

Tabulated data are reported on the manganese content of various cereals, oils, vegetables, eggs, fish, milk, coffee, tea, condiments, and miscellaneous substances. The oils examined were found to contain little or no manganese, but the other materials in amounts showing wide variation, not only from one foodstuff to another, but between different samples of the same material. Refined cereals such as rice and wheat were found to have lost nearly all of their manganese content. Of the whole cereals examined, oatmeal proved to be the richest in manganese, containing 348 mg. per kilogram. One sample of tea was richest in manganese of all of the substances examined, containing 546 mg. per kilogram, but tea infusion contained almost no manganese.

Blood regeneration in nutritional anemia: Influence of iron, iron and copper, nickel, cobalt, germanium, or sodium germanate, H. H. BEARD, V. C. MYERS, and R. A. SHIPLEY (*Soc. Expt. Biol. and Med. Proc., 26* (*1929*), *No. 6, pp. 510, 511*).—In this preliminary report data are summarized indicating that traces of copper, nickel, cobalt, germanium, and sodium germanate added to iron bring about regeneration of erythrocytes and hemoglobin in young rats made anemic on whole milk feeding more rapidly than does iron alone.

The relation between malnutrition and nervousness, Part I, M. and G. Seham (*Amer. Jour. Diseases Children, 37 (1929), No. 1, pp. 1–38, figs. 22*).—In the first part of this paper data are reported and discussed on the effect of varying degrees of malnutrition (quantitative) on the activity and weight of 10 male rats, with 10 additional rats serving as controls. These point to a direct relationship between undernutrition, excessive activity, and underweight. These results are then correlated with the results of a questionnaire on the efficiency and habits of living of 100 normal and 100 malnourished children, the latter showing marked nervousness and fatigue and a much lower efficiency. The clinical observations are considered to confirm the evidence from the experimental study that poor nutrition results in excessive activity. As a therapeutic measure for undernourished children, the authors advise a forced feeding rest cure and give several case reports showing rapid gains in weight and improvement in nervous symptoms following such treatment.

Effect of different levels of protein intake on reproduction, R. Foust and V. E. Nelson (*Soc. Expt. Biol. and Med. Proc., 26 (1929), No. 6, pp. 521–522*).—In the studies noted in this preliminary report the basal diets used (presumably with rats) consisted of casein at varying levels of from 18 to 79.3 per cent of the diet, salt mixture 3.7, wheat embryo 12, cod-liver oil (Squibb) 5, and dextrin to make 100 per cent.

It is stated that growth was normal on levels of 18 to 60 per cent casein, inclusive, but below normal on higher levels. Reproduction was good on all levels of casein, but was delayed on levels above 60 per cent. The young were weaned most successfully on the 18 per cent level. No young were weaned on the 79.3 per cent level. Growth was stunted on all levels above 25 per cent.

Human skin temperature as affected by muscular activity, exposure to cold, and wind movement, F. G. Benedict and H. S. Parmenter (*Amer. Jour. Physiol., 87 (1929), No. 3, pp. 633–653, fig. 1*).—A simple technique for the measurement of skin temperature based upon the thermoelectric principle is described, and data are reported on its use in determinations of skin temperature before and after prolonged periods of walking, snowshoeing, and coasting and during the metabolism studies on walking previously noted (E. S. R., 60, p. 593). The subjects of these determinations were students at Mount Holyoke College. In addition, studies were made at the Nutrition Laboratory of the Carnegie Institution of walking on a treadmill without wind movement and of exercise when nude.

The facts thought to be definitely established by these measurements are that exposure to severe cold with or without strenuous muscular exercise results in a lowering of the skin temperature, chiefly of the extremities. During short periods of severe exercise, even at rather high temperatures, with an increase in metabolism of 500 or 600 per cent, there is a simultaneous lowering of the skin temperature. Preliminary cooling of the skin followed by severe exercise does not cause any increase in skin temperature. It is suggested that the lowering of temperature is caused by a vasoconstriction of the peripheral vessels resulting in a temporary transport of blood from the periphery to the muscles.

The respiratory quotient, H. B. Richardson (*Physiol. Rev., 9 (1929), No. 1, pp. 61–125, fig. 1*).—Of particular interest in this extensive review of the literature on the respiratory quotient in health and disease is a diagram showing graphically various influences which may affect the intermediary reactions and thus the final quotient.

"If the respiratory quotient is used uncritically, the tendency is to jump from the beginning to the end of the diagram, disregarding all the modifying influ-

ences. This is quite justifiable when the subject of the observation is in a static condition, and a large volume of valuable work has been done on this basis. When, however, the observation is carried on under varying conditions, as may be the case in exercise, ketosis, diabetes, insulin therapy, and the formation of fat from carbohydrate, a critical scrutiny of the respiratory quotient is in order."

An extensive bibliography is appended.

Relative vitamin A content of four oriental foods, H. E. SHERMAN (*Philippine Jour. Sci., 38 (1929), No. 1, pp. 1–7, figs. 7*).—In this study the foods tested, with the exception of the Chinese persimmon, were prepared by cooking in an autoclave for 40 minutes at 15 lbs. pressure and drying in a current of air below 60° C., and in most cases were incorporated in the basal ration and fed from the start without the customary preliminary depletion period.

A single rat growth curve is given, showing the cure of xerophthalmia and resumption of growth on 2 gm. daily of fresh Chinese persimmon. In addition, growth curves are given showing continued growth on 5 gm. of fresh persimmon daily. Xerophthalmia was cured and growth resumed on 5 per cent of the flower of *Hemerocallis flava*. The addition of 10 per cent of the material to the basal diet after 8 weeks caused rapid increase in growth. Soybean curd incorporated in the basal diet to the extent of 10 per cent, later increased to 30 per cent, prevented xerophthalmia but growth was subnormal.

Terminology of "vitamin B," E. C. VAN LEERSUM (*Science, 69 (1929), No. 1780, pp. 166, 167*).—The author suggests the terms F (B) and G (B) for the two factors of the vitamin B complex. In his opinion "the advantage of this nomenclature is that it meets everybody's wishes and is not entirely arbitrary. It would be better to retain the letter B for the present, till those who are not workers in this field of research have become used to the single F and G, for the letter B stands for a certain conception which, untenable though it may have proved to be, will but slowly disappear from popular literature to make place for a more correct term."

***Experiments with reference to the more heat-stable factor of the vitamin* B group (factor P-P, vitamin B_2, or G)**, H. C. SHERMAN and M. R. SANDELS (*Soc. Expt. Biol. and Med. Proc., 26 (1929), No. 6, pp. 536–540*).—The experiments reported in this paper include determinations of the solubility of vitamin G in alcohol at varying concentrations and studies of the effect of graded doses of this vitamin upon the weight curves and condition of rats.

In the first series 400 gm. of air-dry baker's yeast was thoroughly mixed with 1,500 cc. of alcohol (80 per cent by weight) and allowed to stand at room temperature (20 to 25° C.) for 24 hours, after which it was filtered with suction, the residue washed with 750 cc. of alcohol of the same strength, and the extraction repeated as before. The combined filtrates and washings formed a clear yellow solution of pH 6.1, which, after concentration on the steam bath and evaporation at room temperature on cornstarch, proved by feeding experiments to contain the greater part of the antineuritic vitmain F but almost none of the heat-stable vitamin G. The residue, however, was somewhat less potent than the original yeast.

Similar extraction with alcohol 60 per cent (by weight) gave a yellow-brown solution of pH 5.9, which showed decided activity after concentration but was less potent than the extracted residue. This appeared to retain about one-half of the activity of the dry yeast as the source of the heat-stable factor. Extraction with 95 per cent alcohol (by weight) gave a pale solution of pH 6.4, containing about 7 per cent of the solids of the yeast but inappreciable amounts of vitamin G. The extracted residue seemed as potent as the original yeast.

it is suggested that there may have been some destruction of vitamin G, perhaps through oxidation during the preparation and drying of the alcoholic extracts.

In the feeding experiments the Sherman-Spohn basal vitamin B-free diet (E. S. R., 51, p. 368) was used, supplemented with an alcoholic extract of ground whole wheat as the source of the antineuritic vitamin. The rats were kept on the basal diet alone until growth had ceased and slight loss in weight had taken place. They were then fed separately three times a week, as a supplement to the basal diet, the preparations to be tested including the yeast and the various extracts and residues, which were first concentrated on the steam bath and then evaporated on cornstarch at room temperature.

Under the conditions of the experiment the feeding of graded amounts was followed by growth somewhat proportional to the amount of the supplement. On diets as free as possible from vitamin G, young rats began to lose weight generally within two weeks. Symptoms of the degeneration did not appear until several weeks later. These are described as follows: "Soreness of the eyes appears with abnormal secretion and a tendency to sticky lids, and to frequent rubbing and occasional scratching of the lids by the animal; in many cases the fur then falls out around the eyes, leaving bald inflamed rims; usually the mouth becomes sore, first with indications of excessive salivation, then with inflammation at the corners, sometimes progressing to an inflamed or ulcerated condition of the entire lower lip; in many cases, though less regularly, soreness of the nose develops with occasional bleeding; the animal becomes weak and tends to remain in a humped posture; in the advanced stages of this deficiency disease, diarrhea is common and there may be bloody discharges, both in feces and urine."

With less complete deprivation of vitamin G, skin lesions were much more prominent. "In these latter less rapidly fatal cases, the fur becomes dry and pulls out readily. Often a definite saddle-like pattern appears on the fur of the back. An examination of the area affected may reveal small dry cream-colored scales on the skin, which later may be replaced by larger yellowish crusts, appearing on the sides of the back, the shoulders, and the chest. The skin lesions usually show a tendency to symmetry; there are occasional cases of rough, red areas upon the paws and the inside of the forelegs; there may be more or less pronounced development of other symptoms, such as have just been mentioned as characteristic of the more acute cases."

The authors are of the opinion that this heat-stable vitamin is of equal importance with the longer known vitamins as an essential factor in animal nutrition, and that the condition resulting from its deficiency "is essentially a dietary deficiency disease in the sense in which this term is ordinarily used by students of nutrition, although, as in the case of vitamin A, the typical clinical picture may include the results of infection or infections, the incidence and development of which become prominent under the conditions of the nutritional deficiency."

Relative solubilities of the antineuritic and antipellagric vitamins in alcohol, and a study of certain properties of these substances, M. R. SANDELS (*Diss., Columbia Univ., New York, 1928, pp. 71+[5], figs. 9*).—Essentially noted above.

Routine use of the vitamin B factor in infant feeding, R. H. DENNETT (*Jour. Amer. Med. Assoc., 92 (1929), No. 10, pp. 769–772, figs. 2*).—This is a report from the pediatric department of the New York Post-Graduate Medical School and Hospital of the results obtained in the routine administration of Vitavose, a wheat germ sugar rich in vitamin B, to 150 infants for periods of from 2 to 10 months. The sugar as tested on rats was estimated to contain

from 90 to 100 times as much vitamin F and from 25 to 35 times as much vitamin G as good milk. It contained maltose 38, maltodextrins 20, dextrins 20, soluble proteins 8, soluble amino and other nitrogenous substances 7, ash 4, and moisture 3 per cent. Its caloric value was 110 calories per ounce (3 level tablespoonfuls). The sugar is said to be well tolerated by the average infant who can take other sugars containing dextrin and maltose, but to be slightly more laxative than other malt sugars. It was given in amounts varying from 1 to 4 level tablespoonfuls per day in a simple dilution of whole cow's milk and water or of boiled or dried milk. The general results obtained are reported for the first group of 129 infants, and more detailed results for a second group of 21.

In the first group the average age at which the sugar was started was 2 months, and at which it was discontinued, 9 months. During the 5-month period the average gain in weight was 12 lbs., 3 oz. In all of the infants in the second group there had been a period of from 2 to 5 weeks just before the experiment was started when growth had stopped and loss of appetite and fretfulness had appeared. On administering the wheat germ sugar the improvement was not always immediate, but with improvement of appetite a prompt increase in weight took place. The average weight of these infants was much higher at the end of the 5-month period than is customary for children of that age.

The author agrees with Hoobler (E. S. R., 60, p. 195) that some source of vitamin B should be given as a routine measure to infants, and recommends this sugar as more conveniently used, more palatable, and more easily available than yeast.

Observations on vitamin B deficiency in pigeons (including the occurrence of refection), J. Taylor and U. Thant (*Indian Jour. Med. Research, 16 (1929), No. 3, pp. 747–765, pls. 5*).—The condition described by McCarrison under the name of beri-beri columbarum (E. S. R., 60, p. 394) has been observed in pigeons on diets of autoclaved rice and a mixture of autoclaved rice and autoclaved dhal, but it was prevented by the substitution of fresh dhal for the autoclaved. This is thought to indicate that the condition is due to deprivation of the antineuritic vitamin alone. Dhal (pulses) and atta (coarsely milled wheat), both of which are used for the prevention of beriberi in India, were found to have quite different antineuritic properties on cooking by the customary method, dhal proving quite inferior to atta. During the course of these studies the phenomenon of refection, as described first by Fridericia et al. (E. S. R., 58, p. 792), was observed in some adult pigeons on diets containing the autoclaved or cooked dhal, but not on autoclaved rice alone.

An attempt to secure "refection" in rats, L. B. Mendel and H. B. Vickery (*Soc. Expt. Biol. and Med. Proc., 26 (1929), No. 7, pp. 552–555*).—The authors, with the cooperation of H. C. Cannon, have attempted to produce in rats the condition of refection as first described by Fridericia et al. (E. S. R., 58, p. 792), by following closely the technic of Kon and Watchorn (E. S. R., 59, p. 686).

Of six rats on a diet devoid of vitamin B and containing 54 per cent of potato starch prepared in the laboratory, four quickly declined in weight and died. another lived somewhat longer, and one grew at a slow rate for 40 days, after which it declined in weight and then maintained its weight at a lower level for more than two months. The feces of this rat were lighter in color than usual, but not white. Four rats on the same diet, with the exception that cornstarch replaced the potato starch, declined in weight. Two of these when almost moribund were fed feces from the surviving rat in the other group and lived for some little time.

It is noted also that in hundreds of experiments on vitamin B-free diets over a period of many years no phenomenon such as that described under the name of refection has been observed. It has been suggested that potato starch at times may carry traces of vitamin B, and that this may explain the delayed symptoms noted in one of the animals.

Relative water-soluble vitamin C content of nine oriental fruits and vegetables, H. E. SHERMAN (*Philippine Jour. Sci., 38 (1929), No. 1, pp. 37–46, figs. 10*).—Supplementing an earlier study (E. S. R., 49, p. 563) data are reported on the vitamin C content of nine oriental fruits and vegetables, among which the pomegranate and Chinese cabbage are considered to be rich sources and the water chestnut, *Eleocharis tuberosa*, a good source of vitamin C.

On 5 cc. of pomegranate juice as the sole source of vitamin C, four guinea pigs weighing between 200 and 230 gm. each were protected from scurvy and grew at a fair rate for an experimental period of nine weeks. The Chinese cabbage in 3-gm. daily amounts protected guinea pigs weighing from 240 to 300 gm. for an experimental period of more than eight weeks. Three out of four guinea pigs weighing from 320 to 340 gm. were protected from scurvy for nine weeks by 10 cc. of the juice of the water chestnut.

Studies on scurvy, A. W. MEYER and L. M. McCORMICK (*Stanford Univ. Pubs., Univ. Ser., Med Sci., 2 (1928), No. 2, pp. 107, pls. 10, figs. 6*).—In this complete report with experimental data and illustrative photographs of the investigation which has been noted previously from a preliminary report (E. S. R., 59, p. 295), chapters on The Symptomatology and Gross Morphology of Experimental Scurvy in the Guinea Pig and The Minute Morphology of Experimental Scurvy in the Guinea Pig are contributed by A. W. Meyer, and a chapter on Some Characteristics of the Blood of the Guinea Pig in Experimental Scurvy by L. M. McCormick. Numerous literature references are given at the end of each chapter.

Studies on scurvy, R. McCARRISON (*Brit. Med. Jour., No. 3549 (1929), p. 69*).—A review of the monograph noted above.

A study of the effect of various agents, chiefly sunlight, upon the susceptibility of rachitic rats to infection, E. C. ROBERTSON (*Amer. Jour. Hyg., 9 (1929), No. 1, pp. 75–96*).—This study was undertaken to supplement the investigation of Tisdall and Brown on the antirachitic power of the sun at different seasons of the year (E. S. R., 58, p. 495), the object being to determine whether the sunshine had an effect upon the resistance of the rats to infections as well as to rickets. For purposes of comparison some rats were irradiated with a quartz mercury vapor lamp, some were exposed to the cold air without sunshine, and some were fed cod-liver oil or irradiated ergosterol. Some difficulty was experienced in finding a suitable infecting organism and in determining the best method of inoculation. A strain of *Bacillus coli* was finally used, and the animals were inoculated intraperitoneally.

Rachitic rats exposed to the sun for 2 hours daily (11 a. m. to 1 p. m.) for 4 weeks appeared to have a greater resistance to infection than corresponding rats kept inside. Of 263 sun-exposed rats 57 per cent, and of 241 indoor rats 32 per cent, survived. Rachitic rats exposed to the mercury vapor lamp at a distance of 30 in. for 15 minutes daily for 4 weeks proved more resistant than indoor rats, but somewhat less resistant than the corresponding rats exposed to the sun. A few rats exposed to the lamp for a shorter period showed as high a resistance as the sun-exposed rats. The rachitic rats kept in the cool outside air but protected from the sun showed very little increase in resistance to infection over those kept inside. Although there was considerable variability in the results with cod-liver oil and irradiated ergosterol, the former did not

appear to increase the resistance to infection while the latter did. Normal rats exposed to the sunshine for 2 hours daily for 4 weeks did not withstand the artificial infection as well as similar rats kept inside.

Influence of superheating on antirachitic properties of irradiated foods, A. L. Daniels and D. Jordan (*Soc. Expt. Biol. and Med. Proc., 26 (1929), No. 6, pp. 453–455*).—A comparison is reported briefly of the growth rate of comparable groups of rats on a rachitic diet and on the same diet irradiated, irradiated and autoclaved at 15 lbs. pressure for 1 hour, and supplemented with boiled milk, irradiated boiled milk, irradiated milk subsequently autoclaved, evaporated milk, and evaporated milk with the addition of calcium phosphate.

The results indicate that superheating, at least to the extent involved in the experiment, does not affect the antirachitic properties of the food.

Observations on the use of irradiated ergosterol in active rickets, J. Sobel and I. Claman (*Arch. Ped., 46 (1929), No. 1, pp. 1–16, figs. 2*).—This contribution from the pediatric service of the Hospital for Joint Diseases, New York City, discusses from the clinical point of view the results obtained in the use of irradiated ergosterol, Vigantol, in the routine treatment of rickets at this hospital since February, 1928.

In the opinion of the authors "irradiated ergosterol is a powerful, reliable, therapeutic, specific agent for active rickets. Until it is biologically standardized it is safer and wiser to use smaller rather than larger doses. It is better to increase the dosage under observation, clinically, serologically, and Roentgenologically, than to be compelled to reduce it because of unfavorable signs or symptoms. From the standpoint of vitamin D it promises to supplant cod-liver oil and ultra-violet therapy. Cod-liver oil will still find its usefulness for its ophthalmic or fat A vitamin content, and ultra-violet therapy for its general 'tonic' effect and improvement of the general metabolism."

Comparative study of the value of the biological and physical assay of irradiated ergosterol [trans. title], R. Fabre and H. Simonnet (*Compt. Rend. Acad. Sci. [Paris], 188 (1929), No. 5, pp. 424–426, figs. 3*).—The authors are of the opinion that it is premature to attribute the biologically active product formed from ergosterol by ultra-violet irradiation a definite absorption spectrum and, in illustration, present absorption curves of ergosterol irradiated in different ways but possessing the same antirachitic property.

Some considerations on the attempt at verification of the activity of irradiated ergosterol [trans. title], R. Fabre and H. Simonnet (*Jour. Pharm. et Chim., 8. ser., 9 (1929), No. 7, pp. 331–338, figs. 2*).—Essentially noted above.

Effect of thyroparathyroidectomy on the action of irradiated ergosterol, A. F. Hess, M. Weinstock, and H. Rivkin (*Soc. Expt. Biol. and Med. Proc., 26 (1929), No. 7, pp. 555, 556*).—In line with the suggestion made in a previous paper (E. S. R., 60, p. 394) that irradiated ergosterol may increase the calcium content of the blood by acting on the parathyroid glands, the authors have carried out several parathyroid extirpation experiments on monkeys and dogs with previous or subsequent administration of irradiated ergosterol.

After large doses of irradiated ergosterol were given for a period of some weeks, the removal of the parathyroid glands did not result in the rapid fall in calcium which usually follows such removal. This is attributed to a storage of calcium in the tissues. The administration of irradiated ergosterol after removal of the parathyroids did not induce hypercalcemia or raise the calcium level to an appreciable extent.

It is pointed out that the effect of irradiated ergosterol is different from that of parathyroid extract, in that the former increases both the calcium and phosphorus content of the serum while the latter does not increase the phos-

phorus until hypercalcemia is marked and the animal is in a weakened condition. It is noted also that the hypercalcemia brought about by irradiated ergosterol is more prolonged, both in man and animals, than that following injections of parathyroid extract.

Molasses, sorghum, and honey as sources of vitamin E, M. W. TAYLOR and V. E. NELSON (*Soc. Expt. Biol. and Med. Proc., 26 (1929), No. 6, p. 521*).—In this preliminary report it is stated that crude cane or blackstrap molasses when added to a synthetic vitamin E-free diet furnishes a good source of vitamin E at a 3 per cent level. At a 5 per cent level 92 per cent of the young were successfully weaned as compared with 58 per cent at the 3 per cent level. It is also stated that beet molasses and sorghum contain some vitamin E, but much less than cane molasses; that of the various kinds of beet molasses straight beet molasses is richest in E; and that with honey at 3 and 5 per cent levels as the source of vitamin E no young have been obtained.

Fundamental food requirements for growth of rat.—V, Influence of fat in diet, L. S. PALMER and C. KENNEDY (*Soc. Expt. Biol. and Med. Proc., 26 (1929), No. 6, pp. 427–430*).—In continuation of the series of studies previously noted (E. S. R., 59, p. 489) the authors have conducted several feeding experiments with rats on diets containing varying proportions of fat but otherwise supposedly adequate.

Contrary to the results reported by Evans and Burr (E. S. R., 59, p. 489), there appeared to be no relationship between the growth attained and the fat content of the diet. The best growth for both sexes was secured with the fat-free-sugar diets which Evans and Burr found to depress the growth rate. Calculations of food consumption and utilization showed that for both males and females the increasingly greater growth rate was associated with either increased food consumption or greater efficiency of food utilization or with both of these factors.

"It seems to us that there are no convincing data at hand to warrant the postulation of an essential growth vitamin F associated with fat. We venture the opinion that the differences observed by Evans and Burr could be readily explained on the same bases as our own, if the data were available."

A study of endemic pellagra in some cotton-mill villages of South Carolina, J. GOLDBERGER, G. A. WHEELER, E. SYDENSTRICKER, W. I. KING, ET AL. (*U. S. Pub. Health Serv., Hyg. Lab. Bul. 153 (1929), pp. VI+85, figs. 20; abs. in Pub. Health Rpts. [U. S.], 43 (1928), No. 41, pp. 2645–2647*).—This publication contains the report, from 1917 on, of the general phases of the pellagra investigation conducted from 1916 to 1921, inclusive, in some representative textile mill communities. The details of the investigation for 1916 have been published separately (E. S. R., 45, p. 768), as well as the special studies arising from the general investigation which have led to the conclusion that pellagra is caused by the absence from the diet of a special pellagra-preventive factor possibly identical with vitamin G (E. S. R., 55, p. 890).

NOTES

California University and Station.—A new horse barn has been dedicated at the University Farm at Davis. This barn is 64 by 130 ft. in size, is finished in stucco to the eaves, with shingle roof, accommodates 40 horses, and cost approximately $9,000.

Dr. W. H. Chandler, professor of pomology, has succeeded Dr. W. L. Howard as head of the division. Dr. E. A. Stokdyk, marketing extension specialist in the Kansas College, has been appointed associate in agricultural economics in the station. Edward S. Hughes has been appointed associate in pomology at Davis.

Colorado Station.—The only recent change in the State appropriations has been an addition of $2,000 to the $6,000 annual allotment for the support of the work of the seed laboratory, this beginning on July 1.

An addition, 40 by 80 ft. and one story high, is being made to the zoology and entomology building. This addition will be greatly appreciated because of its fireproof construction and will be used almost entirely for teaching and investigation in entomology.

Thomas J. Warren of Fort Collins and Dr. O. E. Webb of Milliken have been appointed to the State Board of Agriculture. Of these, the first named succeeds A. A. Edwards, former president of the board, who had served as a member for 24 years.

Recent changes in the station staff include the resignations of Ida W. Ferguson as assistant in bacteriology on September 1; Walter S. Ball, assistant in botany on weed control, to have charge of the weed eradication work of the California State Department of Agriculture; and Dr. Henry L. Morency, associate in veterinary pathology, to become public health inspector at Boulder. Florence N. Schott has been appointed associate in home economics research.

Georgia Station.—Dr. W. G. Friedemann resigned September 1 as chief chemist to become professor of chemistry at Brenau College, Gainesville, Ga.

Purdue University.—Ex-governor Chase S. Osborn of Michigan, an alumnus of Purdue, has given to it a tract of 5,200 acres of timber land in the northern peninsula of Michigan valued at about $200,000. The use of any funds derived from this property is left entirely to the discretion of the university board of trustees.

Iowa College.—Millard Peck, senior agricultural economist in the U. S. D. A. Bureau of Agricultural Economics, has been appointed professor of agricultural economics.

Kentucky University and Station.—E. C. Johnson, assistant in marketing and for the past year acting head of the department of markets and rural finance, resigned September 10. Recent appointments include W. A. Price as head of the department of entomology and botany on September 1, Blanche A. Tansil as assistant professor of home economics, and in the station Ruth Boyden and Clifton J. Bradley as assistants in home economics and marketing, respectively.

Louisiana University.—R. A. Wasson, assistant professor of agronomy in the Ohio State University, has been appointed extension agronomist.

Michigan College and Station.—Dr. Harold S. Patton has been appointed professor of economics and economist in the station and entered upon his duties September 1. Dr. Marie Dye, associate professor of home economics and home economist in the station, has been made dean of home economics, effective August 1. Other appointments, effective September 1, include Lillian Francis as associate professor and research assistant in home economics and M. F. Babb, instructor in horticulture in the University of Maine, as instructor and assistant in research in horticulture.

Alex Laurie, assistant professor of floriculture, has accepted a position as professor of floriculture in the Ohio State University.

Missouri University.—O. E. Allen, assistant extension professor of soils, has resigned to become commissioner of agriculture of the St. Louis Chamber of Commerce. A. F. Stephens, assistant extension professor of dairy husbandry, has resigned to become associated with the agricultural department of the Wabash Railway.

New Hampshire University.—Elizabeth Ellis has succeeded Louise R. Whitcomb as nutrition specialist.

Oregon College.—An act of the last legislature has consolidated into a single board of nine members the governing authorities of the five higher educational institutions of the State and the former board of higher curicula. The new board, which is known as the State Board of Higher Education, assumed control on July 1 and consists of the following: Herman Oliver of Canyon City for 1 year; A. R. Watzek of Portland for 2 years; F. E. Callister of Albany for 3 years; E. C. Pease of The Dalles for 4 years; Albert Burch of Medford for 5 years; and E. C. Sammons, C. L. Stair (chairman), B. F. Irvine, and C. C. Colb, all of Portland, for 6 to 9 years, respectively.

The appropriations and incomes for the several institutions for the current biennium are not to be disturbed other than by prorating among them the board's own expenses, but on July 1, 1931, the board is to inaugurate its own program. Full authority is given to reorganize the work of each institution to eliminate unnecessary duplication of equipment, courses, departments, schools, summer schools, extension activities, offices, laboratories, and publications. In the interim the board is to make a complete survey of State-supported higher education in Oregon, using a special appropriation of $10,000 for the purpose.

The various millage taxes for the different institutions are consolidated into a single State tax of 2.4 mills. A standardized system of accounts and records is to be prescribed by the board, and in the preparation of the budget the board is authorized to allocate all funds from all sources. It is instructed, however, to foster gifts to the separate institutions by faithfully devoting them to the institutions for which they are intended.

Rhode Island Station.—On September 1 Alice R. Miller succeeded Helen J. Weaver, resigned as assistant in animal breeding and pathology. Frank S. Schlenker succeeded J. Eric Blaney, resigned, as assistant chemist on the same date.

South Dakota College.—T. S. Thorfinnson, extension specialist in farm management in the Oklahoma College, has been appointed to a similar position in this State and will direct his efforts to encouraging the use of farm and cost accounts. A. M. Eberle has been appointed extension specialist in farm management and marketing. Samuel S. Reck, Jr., has been appointed extension editor vice Alan Dailey, resigned to become a writer in the Radio Service of the U. S. Department of Agriculture. Anita Andrews has been appointed clothing specialist.

Texas College.—Thomas R. Hamilton, assistant economist in the division of statistical and historical research of the U. S. D. A. Bureau of Agricultural Economics, resigned September 5 to become assistant professor of statistics.

Utah College.—Charles M. Genaux, assistant in forestry in the University of Washington, has been appointed extension forester, a new position.

West Virginia University and Station.—R. O. Stelzer has been appointed assistant in farm economics vice Paul Eke.

Agricultural Education in England.—A farm institute for the County of Kent has just been opened with T. W. McDougall Porter as principal. The institute is to be located at Borden, near Sittingbourne, in a region noted for the cultivation of fruit and hops. Buildings erected in 1878 for the Borden Grammar School have been remodeled and completely equipped for instruction purposes. Dormitory accommodations are available for 40 resident students. In addition to a tract of 7 acres in which the buildings stand, a farm of 250 acres is available at a short distance, of which 72 acres is in fruit orchards and plantations, 10 acres in hops, 125 acres available for arable crops, and 40 acres in grass. A model dairy is being built, and poultry equipment will be provided for about 1,000 laying birds. The school will be of secondary grade with special emphasis on commercial fruit growing. Short courses will also be provided in milk production, horticulture, hop drying, etc.

Junior courses organized two years ago by the Salop Agricultural Committee have proved so successful that they are to be extended throughout the country, using 27 centers. The courses run from October to March and are of elementary grade. Courses for girls in farm house management have also been started.

Laboratory of Agricultural Chemistry of the Chinese Eastern Railway.—This laboratory was opened in Harbin, Manchuria, early in 1923 as a branch of the land department of the Chinese Eastern Railway. Many analyses of soils, plant and animal products, and similar materials were made for the land department in connection with its demonstration fields and also a considerable number of private individuals. In 1925 a study of the cereal grains and other products exported from northern Manchuria was begun. Special attention has been given to corn and sorghums and particularly to soybeans and their products, standards for which have been formulated as a result of its work.

The staff of the laboratory consists of a director and agriculturist, a chief chemist, three associate chemists, and six assistants. It is hoped in the near future to organize the work into sections for research on products of plant and animal origin, soils, fertilizers and similar materials, and pests and diseases of cereals and other crops, including forests.

Waite Institute for Agricultural Research, South Australia.—The work of this institute (E. S. R., 52, p. 798) has been considerably handicapped by a shortage of laboratory facilities. This difficulty has now been overcome in part by the opening of the John Melrose Laboratory. The first wing of what will eventually constitute a large group of laboratory buildings has been completed through a gift of £10,000 by Sir John Melrose. This wing is a two-story structure with a total floor space of 14,700 sq. ft., the ground floor being devoted to administrative and botanical work and the second floor mainly to chemistry but with provision for entomology.

A project for the joint establishment of a division of soils research at the institute is under consideration by the Council for Scientific and Industrial Research of Australia and the University of Adelaide.

EXPERIMENT STATION RECORD

Vol. 61 November, 1929 No. 7

Another report is now available from the Office of Experiment Stations on the work of the agricultural experiment stations. This report covers the fiscal year ended June 30, 1928, and summarizes for this period the progress of the stations as a whole. As usual it assembles in convenient form statistical and other data otherwise widely scattered and difficultly available, and discusses the work, the findings, and the outlook of these institutions as components of a national system of research. In accordance with the policy of recent years, it also gives large attention to the consideration of some of their problems of organization and administration, and it contains to a notable degree a wide range of constructive suggestions looking toward their further development and upbuilding.

Attention is drawn to the fact that the year under report marked the fortieth anniversary of the stations as a country-wide system receiving Federal aid. The first appropriation under the Hatch Act was in 1888 and aggregated $585,000. This sum was supplemented by about $125,000 derived from State appropriations, fees, sales of farm produce, and other sources, making the total amount available to the stations in that year about $710,000. In 1928 the Federal contribution was $3,360,000 and that from other sources $11,442,773, a total of nearly $15,000,000. In other words, the revenues increased during this period more than twentyfold.

Likewise there is revealed an enlargement in personnel from about 400 to 3,013 individuals. Practically speaking, the growth in available man power has been much greater than even these numbers indicate, since with many individuals a larger percentage of time free from teaching and other duties is now obtainable. Where formerly the station work was in large part secondary or incidental to other college activities, it has now become to a large extent a primary one for leading workers.

As regards the grade of the station work, the contrast is no less striking. In their early history the stations were called upon to do a large amount of regulatory and service work not permitted under the Federal funds but supported by State appropriations. To

an increasing extent such work is now being taken care of by other agencies, and the stations are thus left free to devote their resources and energies more strictly to research. Where once a large share of the work was done by the simpler observational and experimental methods in field, orchard, and feeding stall, to-day the more exact and quantitative methods of laboratory, plant house, and respiration chamber, and other refinements are being relied upon to a far greater extent, with many improvements in technic and method.

The development of fundamental research with an ultimate practical aim has come to be the prevailing idea in experiment station work. This development is reflected in the many buildings specially designed and equipped for advanced investigation, and even more strikingly in the extent of specialization and more rigorous preparation on the part of their staffs. It is pointed out, however, that " this growing intensity and specialization, with laboratory and controlled facilities so largely taking the place of natural farm conditions, has not made the experiment stations or their experts any the less practical. On the contrary, it has made them more efficient and reliable, and able to reach further into an understanding of the factors and the reasons involved in complex questions—to follow much further the connection between causes and effects.

" The search for fundamental knowledge," it is stated, " frequently leads into the field of pure science, but by this means a surer foundation is laid for the solution of practical questions. It is only by such means that the 'what,' 'how,' and 'why' of many basic problems can be determined, and until this is done no problem can be considered intelligently solved. In the realization of this and with increasing financial support stimulated by public confidence and demand, the stations are enlarging their fundamental studies along with the scope and variety of their activities, and with these things comes a clearer conception of what is involved in the effective organization and execution of research."

A further idea of the growth of the existing national system may be gleaned from the statement that in addition to the more than 50 stations receiving Federal aid in the various States and Territories and more important insular possessions, there are no fewer than 114 substations of a permanent nature connected with the State stations, designed to serve the problems of special localities or particular branches of the agricultural industry, such as cranberry growing, the blueberry industry, tobacco growing, the cattle industry under range conditions, and the like. The work in the States is further supplemented by 59 experimental farms and 255 experimental fields employed to carry on tests of the local adaptation of crops and practices, determine the fertilizer needs of different types of soils, etc. Con-

ıred collectively it is indicated that from small beginnings the em has become not only "the most extensive and far-reaching ever built up for agricultural inquiry; it is the largest organized rt for research in any branch of science or industry. And it is a *growing* enterprise.

The development to the present magnitude is a reflection of the ıt confidence in the power of research, especially when it is orized and is directed to the vital problems of the industry in their .l and national aspects. The broad and extremely varied nature hese problems as presented by the wide extent of the country, and fundamental relations of these problems to the ability of the intry to cope with and adjust itself to changed conditions, are an sistible challenge to administrative officers and workers alike. l the confidence so abundantly evidenced by Federal and State ropriations and by the provision of modern buildings and other led facilities, presents a responsibility for the effective organion and administration of this great enterprise which no one in hority can fail to realize."

'he year under review is deemed unusually prosperous from every le. The financial support was the largest ever attained, and it accompanied by increases in buildings and other permanent ipment and facilities aggregating in value over $1,500,000. The sonnel was enlarged by fully 200 members, and there was a dist gain in acquiring more thoroughly prepared workers and in viding more adequately for matters of administration. Many itions were made to the list of projects, and considerable progress attained in eliminating inactive projects and in bringing others completion. Despite a tendency to publish the more technical ects of investigations in scientific journals, approximately 800 lications were put out in the regular station series, of which r 100 were in economics and sociology alone.

'he popularity of the stations among their immediate constituency tinued to be indicated by increases of nearly $1,500,000 in their me from State appropriations. At each of 5 stations their nonleral funds amounted to over $500,000, and in the case of 14 ions they ranged from $200,000 to $500,000. Only 13 stations a smaller income from State sources than they received from Federal Government, and in only 3 cases was the State support small to be of appreciable aid in promoting agricultural investion.

n recent years the funds of many of the stations have been enged by grants and donations from private sources. In 1928 there e 155 such grants to research divided among 31 stations and

amounting to $348,698. Some of these, relatively small in amount, were from such research agencies as the Carnegie Institution of Washington, the National Research Council, the Chemical Foundation, and the Crop Protection Institute. Farmers' organizations, agricultural associations, chambers of commerce, and the like contributed $79,864, and a total of $31,290 was derived from bequests, legacies, and private endowments.

The largest contributors were various commercial and industrial concerns and associations, aggregating $214,818 and covering a wide range of business activity. Prominently represented were the fertilizer, insecticide, fungicide, food, baking, dairy products, farm machinery, incubator, and canning industries, but there were contributions from brick manufacturers, chemical and fermentation industries, nurseries and bulb growers, forestry and lumber interests, meat packers, and sugar producers. Electric power and equipment companies and other public utilities made a total of 14 grants, mainly for experiments in the utilization of electricity on farms and in connection with agricultural operations. There also were grants from sauerkraut packers, flax development organizations, the United States Golf Association, the Horse Association of America, the Kentucky Jockey Club, dairy cattle associations, and the Outdoor Advertising Association.

The broad question of the propriety of private aid to public instruction is discussed briefly and with reference to the report of this subject by the Committee on Experiment Station Organization and Policy at the 1928 convention of the Association of Land-Grant Colleges and Universities. It is recognized that when public funds are not available for the conduct of research of a special character for which there is immediate need, private grants by commercial agencies may enable the securing of prompt results and thus serve both the contributing interests and those of the public. It is deemed quite evident, however, that the stations will need to consider each new proposal "on its own individual merits, to insure that there is involved neither direct nor indirect interference with their complete and impartial functioning as fact-finding and truth-revealing public agencies."

The general scope and character of the work of the stations is conveniently indicated by the research projects in which they are engaged. For the year under report over 6,600 projects were listed. These projects have been classified as follows: Agricultural chemistry 44, agricultural economics 491, agricultural engineering 268, animal husbandry 973, bacteriology and similar studies 12, botany 26, dairying 121, economic entomology 507, economic zoology 40, field crops 1,758, food technology 17, forestry 122, genetics 181, home

economics 124, horticulture 1,197, meteorology 10, plant pathology 565, plant physiology 69, rural education 14, rural sociology 60, soils and fertilizers 538, and veterinary medicine 217.

Of the 895 Purnell projects about 40 per cent were in the newer fields of agricultural economics, home economics, and rural sociology. These received, respectively, about $550,000, $205,000, and $68,000. Less than 10 per cent of the Purnell projects were in field crops and nearly 8 per cent were in horticulture, to which approximately $140,000 and $120,000, respectively, were allotted. About $120,000 was devoted to studies in soils and fertilizers, and $80,000 to plant diseases, subjects closely related to field crops and horticulture. Approximately $290,000 was expended in the field of animal husbandry and dairying, which included 17 per cent of all the Purnell projects set up. Roughly, about $88,000 was devoted to entomology and economic zoology projects, and $40,000 to $50,000 was used in each of the fields of animal diseases, agricultural engineering, and genetics.

The Adams fund has been more closely restricted to use in the solution of fundamental problems and investigations of more permanent value and more general application. Approximately $125,000 of this fund was expended on projects in soils and fertilizers, $105,000 on projects in plant diseases, and $90,000 on genetic studies with plants and animals. Animal husbandry problems, mainly in nutrition, received $80,000; animal diseases, $70,000; and $55,000 was applied to entomology and economic zoology studies. There were 94 Adams projects on plant diseases, 62 on soils and fertilizers, 59 on genetics, and 49 on entomology and economic zoology.

While new projects were distributed among practically all subjects, there was a distinct tendency for several States or groups of States to work on similar problems. Aside from the national cooperative projects there was much regional cooperation, as in the study of oil sprays, in which individual States concentrated on a special phase of the problem. Practically all of the fruit growing States were much interested in investigations to determine means of removing excess spray residue from fruits. The development of new high-nitrogen-content fertilizers gave impetus to the study of the sources of nitrogen and the nitrogen requirements of special crops in carefully laid-out laboratory and field experiments in which variables were largely under control.

The methods and technic for home equipment studies showed considerable improvement from a research standpoint through consultation and cooperation with agricultural engineers, physicists, and other specialists. Farm management and marketing studies were

being increasingly interpreted with reference to their bearing on national conditions, and their objectives were being directed toward the basic cause of the relationships of the results obtained.

One conclusion drawn is that the number of projects of an empirical nature in animal husbandry and field crops is becoming progressively less. More emphasis in these fields is placed on nutrition, genetics, conditions of growth or production, and disease investigations. Preliminary studies or knowledge already in hand on the applied subject point out the important problem, and it is solved with the aid of one of the more specialized sciences. The cut-and-try method of experimentation is thus being replaced by a more carefully thought-out plan of attack designed to discover basic facts and the range of their application.

Several of the stations have given increased attention to the development of well-balanced and interrelated working programs. For instance, one station has centered its Purnell work quite largely around the canning industry, setting up projects in soils, fertilizers, plant diseases, genetics, entomology, horticulture, plant physiology, and agricultural economics having a direct relation to this industry. Another station has assembled facts about the agriculture and farm homes of the State in several mimeographed publications which are to serve as a record of what is known, and indicate what is needed in the way of agricultural adjustments. Several of the Southern States have endeavored to organize important parts of their research programs around cotton problems, directing attention in their agricultural economics, agronomy, entomology, plant physiology, and plant pathology research toward the solution of problems related to that crop.

Despite marked improvement in the statement of new projects when submitted for approval, attention is drawn to a number of shortcomings which it is thought will affect the productivity of the work unless remedied. These include the formulation of "blanket" projects, broad and indefinite proposals with many objectives or a composite one; projects which fail to take into account what has been done or the general status of investigations on the subject; projects with defective technic or inadequate procedure; and projects which comprise essentially demonstration and routine efforts. Regarding some of these matters it is pointed out that "there is no excuse at the present day for the experimenter to engage in demonstration, and there is even less for him to make experiments to teach himself what he should have learned from the literature."

About 900 of the station projects, or approximately 13.5 per cent, were carried on cooperatively between several stations or with the Federal Department of Agriculture. This was an apparent gain of

50 per cent over the previous year, and involved all of the stations, several being engaged in over 35 cooperative projects each.

According to the report "the idea of cooperation and coordination is growing steadily. The cooperative spirit is more dominant and favorable. Even though the details have not been fully worked out, the outlook gives much encouragement." At the same time it is stated that "much remains to be done to strengthen the movement and to give the features more tangible form. In many cases the cooperation is rather loose and ineffective, lacks organization, and does not go far beyond mutual understanding; often it is quite informal, representing verbal agreements between individuals. Again, relatively few stations have taken up the national projects, especially in some of the newer lines. There has been a disposition to set up projects on independent and unrelated bases, while in other instances the cooperation is indefinite in its conformity to a working plan. Concerted and correlated effort on the national cooperative projects has not been as active as was anticipated. If the efforts at cooperation are to be worth while they will need to receive the active interest and support of administrative officers and not be left wholly to individual workers. . . .

"As the Joint Committee on Projects and Correlation of Research pointed out in its last report, a larger and more effective measure of cooperation and coordination is regarded as one of the greatest needs of agricultural research at the present time. This is not wholly a question of whether or not individuals and institutions shall actively cooperate; it is a matter of relating investigation so that it will give more comprehensive and effective study to leading subjects, avoiding unnecessary repetition and duplication and directing it in an orderly way toward the various features which must be considered before such subjects can be worked out. Such correlation, so far from being a question of subordination of individual initiative and independence, is a challenge to originality."

As usual the report gives much space to a series of summaries of the principal findings in the stations' investigations. These reviews, prepared mainly by members of the *Record* staff, deal in turn with soils and fertilizers, field crops, horticulture, economics, entomology, animal breeding, animal nutrition and production, dairy manufacture, veterinary medicine, foods and nutrition, agricultural engineering, and agricultural economics and rural sociology. Although complete accounts of all the important work in progress at each station have not been attempted, the reviews demonstrate that the stations are endeavoring to solve a wide range of significant agricultural problems and are meeting with marked success in many diverse fields. They also afford concrete evidence of the practical

value of their work and the aid they are rendering in making the agricultural industry more resourceful and efficient.

The report concludes with a special article reviving the custom frequently followed in earlier years of including accounts of significant happenings along research lines in foreign countries. This article deals with some recent developments in agricultural research in the British Empire which look toward the organization of fundamental research on an empire-wide basis and a very extensive scale. This undertaking has been going on for some time under the sponsorship of the Empire Marketing Board and other bodies, and from July, 1926, to May, 1928, involved allotments of over £1,000,000 for research projects and institutions, with supplementary funds from local contributions equivalent to the imperial grants in many cases. Among other phases it contemplates a series of imperial clearing stations for specific branches of research, a chain of central tropical and subtropical research stations, the appointment of a colonial advisory council of agriculture and animal health to coordinate agricultural research in what are termed the non-self-governing dependencies, and the formation of a colonial agricultural service with a specialist wing for research and administrative work.

The dominating motive in this large enterprise is that of making the British Empire more self-sustaining in the matter of foodstuffs, and to that end the development of an imperial consciousness and unity of effort is sought. The plans were matured after extensive and thorough consideration of existing conditions in the Empire and its colonies and of special needs for expansion in various directions. It is interesting to note the emphasis placed on fundamental research designed to discover broad facts and principles, as contrasted with experiments and investigation dealing with local or more limited interests and aspects. The plans evidently contemplate a considerable measure of centralization to attain the desired ends, and look definitely to cooperation and coordination as means of making the various lines of effort as highly effective as possible.

From many points of view this British Empire project is one of the more important developments in agricultural research in recent years. Because of its scope, high purpose, and large possibilities its progress will be followed with unusual interest.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Organic laboratory methods, LASSAR-COHN, trans. by R. E. OESPER, edited by R. ADAMS and H. T. CLARKE (*Baltimore: Williams & Wilkins Co., 1928, pp. XI+469, figs. 186*).—This is a translation of the first volume of the fifth revised edition of this well-known laboratory manual and deals with the general operations of general laboratory technic, the methods for carrying out specific reactions having been dealt with, in the original, in a second volume.

The present volume takes up starting materials and extraction; baths; distillation; distillation under reduced pressure and in vacuo; dialysis; passage of vapors through hot tubes; evaporation in vacuo; sealed tubes; decolorizing and clarifying liquids; extraction by means of liquids boiling under a reflux; filtering and pressing out precipitates; crystallization; solvents and diluents; molecular weight determinations; comminuting and mixing substances; melting point determinations; determination of the boiling point of small quantities of liquid; sublimation; drying of solids and dehydration of liquids, drying of gases and removal of single gases from gaseous mixtures; and detection and determination of nitrogen, the halogens, and of sulfur in organic compounds, and the ashing of organic materials.

Introduction to the analysis of foods and more or less related products, J. GROSSFELD (*Anleitung zur Untersuchung der Lebensmittel. Berlin: Julius Springer, 1927, pp. XII+409, figs. 26*).—This book is intended to supply a condensed selection of the practical information previously distributed in larger works. The text is divided into two parts of which the first deals with general analytical methods represented in part by the following: Sampling, comminution, and mixing; moisture determinations; nitrogen determinations; fat determinations; general methods for the examination of fats and oils; determination of the individual fat components; determination of the carbohydrates; detection and determination of the organic acids; the determination of H-ion concentration; determination of the water extract; determination of the ash and mineral substances; determination of the individual mineral constituents; detection and determination of materials injurious to health; determination of the alcohols; the detection of added coloring matters; the detection and determination of preservatives; and the detection of vitamins.

Part 2 deals with the special analytical methods used for the examination of specific food products—milk, eggs, meats, gelatin, meat extracts, cheese, butter, margarines, cereal foods, flour, bread and other baked goods, yeasts, baking powder, condiments, alcoholic and nonalcoholic beverages, tobacco, air, drinking water, etc.

An appendix contains 41 tables of analytical constants and other data of value in the analysis and interpretation of the analysis of foods and more or less related products.

The investigation and valuation of fertilizers, feeding stuffs, seeds, and soils by the official methods of the Association of German Agricultural Experiment Stations, P. KRISCHE (*Die Untersuchung und Begutachtung von Düngemitteln, Futtermitteln, Saatwaren und Bodenproben nach den offiziellen Methoden des Verbandes landwirtschaftlicher Versuchsstationen im Deutschen Reiche. Berlin: Paul Parey, 1929, 2 ed., rev., pp. XXII+385*).—This is a second and revised edition of the work already noted (E. S. R., 18, p. 208).

The hydrogen-ion concentration.—II, Oxidation-reduction potentials, L. MICHAELIS (*Die Wasserstoffionenkonzentration.—II, Oxydations-Reductions-Potentiale. Berlin: Julius Springer, 1929, pp. X+171, figs. 16*).—This monograph is intended to supplement the author's Hydrogen-ion Concentration (E. S. R., 48, p. 412). The subject is taken up in two primary divisions (1) theoretical considerations and (2) physiological applications, of which the last-named division has as its three main subdivisions the topics of the physiologically important oxidation-reduction systems, the measurement of reduction potentials in physiological systems, and the reduction potentials in cell and tissue suspensions.

A brief introduction precedes the contents noted, and a short résumé, followed by a reference list and subject index, concludes the monograph.

Fats and oils, K. H. BAUER (*Chemische Technologie der Fette und Öle. Berlin: Paul Parey, 1928, pp. XV+423, figs. 48*).—The purpose of this monograph is stated to be that of providing a condensed review of the entire field of the chemistry of the fats and oils, their occurrence, properties, the methods for separating and refining them, the chemistry of their constituents, and the work on the synthesis of fatty and oily products.

The contents include methods for obtaining the plant fats; methods for obtaining the animal fats; the individual constituents of the fats and oils; the synthesis of the fatty acid esters; the analysis of the fats and oils; plant fats and oils; the animal fats; the effects of the air on the fats and oils; the fat products industries (this chapter deals with the commercial hardening of fats and oils); margarine manufacture; the preparation of artificial butter; the hydrolysis of fats; the preparation of glycerin soaps, sulfonated oils, and drying oils; and an appendix containing various chemical and physical analytical constants. A rather full subject index, an author index, and a brief bibliography conclude the volume.

Fruit jellies.—VI, The rôle of pectin.—2, The extraction of pectin from pectic materials, P. B. MYERS and G. L. BAKER (*Delaware Sta. Bul. 160 (1929), pp. 64, figs. 29*).—This is the sixth article (E. S. R, 57, p. 592).

In the course of this study of the preparation of pectin the jelly grade of pectin preparations was found to reach an optimum value when the pectin was extracted at an H-ion concentration of approximately 2.40. This optimum point was found to be independent of the titrable acidity of the extracting medium and also of the nature of the acid used. The use of extraction media of H-ion concentrations higher than that represented by pH 2.40 resulted in a sharp decline in the jellying power of the pectin. This result was interpreted as indicating a partial hydrolysis of a part of the pectin.

The jelly grade of the pectins studied decreased with increases in the time of boiling during extraction. From 5 to 15 minutes' boiling resulted in a sharp decline in jelly grade, boiling from 15 to 30 minutes had scarcely any effect on the jelly grade of the resulting pectin, boiling from 30 to 60 minutes sharply decreased the jelly grade, and boiling from 60 to 180 minutes decreased the jelly grade more gradually in a straight line function of the time of boiling.

Data were obtained from which was drawn the conclusion that the methoxyl content of pectins is not a criterion of their jellying power. The jellying

power of the pectin preparations was found not to be correlated with the yield of pectic acid obtainable from them, the alkali used saponifying some of the hydrolytic products of pectin low in jellying power with the production of pectic acid during the hydrolysis of the pectin itself. The determination of the jellying power of a pectin by the viscosity method was found to be of limited application, though it could be used to determine the jelly grade of pectins prepared by the same method of extraction.

The yield of pectin depended upon the H-ion concentration at which the pectin was extracted rather than the titrable acidity, with a sharp increase in the yield of pectin resulting from increases in the H-ion concentration beyond that represented by pH 4.0. With tartaric acid the maximum yield was obtained at pH 2.0, while with hydrochloric acid the optimum pH value for yield of pectin was at pH 1.45. An increase of the H-ion concentration beyond the optimum for the acid used markedly decreased the yield of pectin, an observation which is considered to indicate that the pectin was hydrolyzed at H-ion concentrations beyond the optimum for the acid used and that the pectin was hydrolyzed with the production of some insoluble products.

The yield of pectin was found to depend also upon the time of boiling during extraction. Between 5 and 60 minutes of boiling the yield increased rapidly, between 60 and 120 minutes the increase was not so pronounced, and beyond 120 minutes practically no increase in yield was observed.

A method of extraction, based upon the above observations and some others of a similar nature, is detailed.

The respiration factor in the deterioration of fresh vegetables at room temperature, M. P. Benoy (*Jour. Agr. Research* [*U. S.*], *39* (*1929*), *No. 1, pp. 75–80, figs. 2*).—Ten green vegetables at the stage described as that of edible maturity were subjected at the Oklahoma Experiment Station to comparative examination with respect to rate of evolution of carbon dioxide during the first 30 hours immediately following harvesting. The total quantity of carbon dioxide evolved between the second and twenty-sixth hours was calculated, and from these data the weights of glucose presumed to have been oxidized in the production of the carbon dioxide found were computed. The vegetables evolved carbon dioxide under the conditions noted in the decreasing order: Asparagus, lettuce, green bean, okra, green onion, carrot, tomato, beet, green mango, and red pimiento, the quantities of glucose per 24 hours, computed from the carbon dioxide figures, ranging from 13.682 gm. per 100 gm. of dry weight with asparagus to 1.290 gm. with red pimientos.

Bacteriological studies on sulfid spoilage of canned vegetables, C. H. Werkman (*Iowa Sta. Research Bul. 117* (*1929*), *pp. 161–180, figs. 6*).—Sulfide spoilage of tinned vegetables, specifically of corn and peas, is a condition characterized by the blackening throughout of the contents of the tin and the formation of hydrogen sulfide without swelling or springing of the tins. In canned sweet corn it was found to be caused by a new type of thermophilic organism designated *Clostridium nigrificans*, which developed, if present, in cases of insufficient processing. The organism showed itself a heat-resistant sporulating anaerobe and a new species.

The spores of the organism were not destroyed in No. 2 tins of sweet corn by processing at 118° C. for 70 minutes. In the case of many tinned vegetables the acidity of the product was found to be such as to prevent the growth of the organism, however, and it is stated that "it would seem that there is little possibility of the organism causing spoilage in vegetables other than peas and sweet corn."

C. nigrificans was found in soil, on manure, and on sugar, and is believed to have entered the canneries from such sources. Eliminating foci of infection in the cannery and the prevention of the presence of spores of the organism in the product, together with the avoidance of the use of raw materials from infected sources, are suggested as means of control.

It is stated that sulfide spoilage has thus far been observed only in canneries of the Middle Western States, and only in peas and corn.

Sulphur-spray residues and the swelling of tin cans packed with peaches, C. W. Culpepper and H. H. Moon (*Jour. Agr. Research [U. S.], 39 (1929), No. 1, pp. 31–40*).—In a detailed study of the effect of the presence of lime-sulfur spray residues and of the chemical mechanism of this effect in packs of unpeeled peaches in tins, contributed from the U. S. D. A. Bureau of Plant Industry, it was found that practically all sulfur compounds, except thiosulfate, likely to be formed in the pack as a result of the original presence of lime-sulfur spray residues caused the swelling of the tins by the formation of gas, consisting largely of hydrogen with smaller quantities of hydrogen sulfide. Washing, either in cold or in hot water, was not always effective in removing the spray residues from the fresh fruit; but dipping the fruit for from 15 to 30 seconds in hot dilute lye, followed by the washing of the fruit with jets of cold water, has been effective, without damage even to rather soft fruit, through the two seasons during which the method has been under trial.

The effect of the sulfur and its compounds appeared to consist both in direct combination with the metal of the container and in a catalytic action which greatly accelerated the corrosion of the container by the natural fruit acids.

"In ordinary canning the acid juices of the peach act as an electrolyte in which iron is cathodic to tin when they are in contact. If hydrogen sulphide is present this relationship is reversed, and iron becomes anodic and tin cathodic.

"In the presence of oxygen or an oxidizing acid, iron is usually cathodic to tin, whereas if a reducing agent, such as hydrogen sulphide is present, the iron is anodic to tin when they are in contact. This relationship, together with the fact that hydrogen sulphide accelerates the liberation of hydrogen from iron, seems to account completely for the swelling of the cans in the cases here described."

The determination of copper in biological materials, C. A. Elvehjem and C. W. Lindow (*Jour. Biol. Chem., 81 (1929), No. 2, pp. 435–443*).—Following a review of a considerable number of methods, no one of which was found entirely satisfactory without modification, the authors present a colorimetric procedure carried out essentially as follows:

Ash thoroughly from 5 to 10 gm. of the material at a dull red heat in an electric muffle to the point of the complete destruction of the carbon. Take up the ash in 15 cc. of hydrochloric acid diluted with its own volume of water and evaporate to dryness on a sand bath to render the silica insoluble. Moisten the residue with 5 cc. of N hydrochloric acid and add 5 cc. of water, warm on the sand bath for one-half hour, filter, and wash the insoluble residue thoroughly to a volume of about 100 cc. Evaporate the filtrate to 10 cc., cool, and transfer to a 25-cc. volumetric flask. Add enough N sodium hydroxide to make the solution just alkaline to phenolphthalein, add 1 cc. of glacial acetic acid, 1 cc. of 10 per cent potassium thiocyanate solution, 10 drops of pyridine, and exactly 5 cc. of chloroform, making up the volume with water. Shake thoroughly, permit the chloroform layer to settle out, remove the greater part of the aqueous layer, and transfer the chloroform layer with the remaining aqueous portion to a Bausch and Lomb colorimeter for comparison with standard solutions made by a similar treatment of known quantities of a pure copper salt.

Prepare the standards from 0.5, 1, and 2 cc. of a solution of pure copper sulfate so made as to contain exactly 0.1 mg. of copper in 1 cc.

It is emphasized that the greatest care is necessary to avoid the introduction of copper as an impurity in the reagents used and from the vessels in which the operations are carried out. New porcelain dishes required to be treated with about 1 gm. of sodium acetate which was ignited in the electric muffle furnace, following which the dishes were extracted for some days in 1 : 1 hydrochloric acid. The distilled water required to be redistilled from glassware and even reagents of the highest obtainable quality should not, it is considered, be used until found copperfree by actual test.

A note on the determination of the digestibility of protein by Bergeim's method, W. D. Gallup (*Jour. Biol. Chem., 81 (1929), No. 2, pp. 321–324*).—It was found that under the conditions imposed by certain diets employed by the author the iron added as ferric hydroxide in Bergeim's method (E. S. R., 56, p. 192) for the determination of protein digestibility could not quantitatively be recovered. Some simple alterations in the procedure were found to permit the substitution of silica for the ferric oxide. "When such a substitution is made . . . the method still retains most of its desirable features." The silica was determined both at the beginning and at the end of the process by ashing the material at a dull red heat and weighing the silica residue remaining insoluble in hydrochloric acid after taking up the ash in acid diluted with an equal volume of water, evaporating to dryness, and baking at 110° C. for 1 hour, and then taking up the residue in 2 cc. of concentrated acid and 10 cc. of water, filtering off, and igniting. Trials comparing the usual method with the iron method and with the silica method were made, data for 4 diets and 22 individual determinations being given.

METEOROLOGY

Observations on certain bioclimatically important temperatures [trans. title], V. Novák (*Věst. Českoslov. Akad. Zeměděl. (Bul. Czechoslovak Acad. Agr.), 4 (1928), No. 9, pp. 802–807; Ger. abs., pp. 805–807*).—This article calls attention especially to the influence of plant cover on the temperature of the air at different heights above the soil up to 2 meters (6.56 ft.). It is shown that the temperature near the soil is sufficiently modified under certain conditions to be of considerable importance in relation to plant growth. The effect of closely clipped sod in lowering the night temperature at 5 cm. above the soil was found to be especially pronounced.

Climatological data for the United States by sections, [1928] (*U. S. Dept. Agr., Weather Bur. Climat. Data, 15 (1928), No. 13, pp. [243], pls. 2, figs. 26*).—This number summarizes the climatological data for each month of 1928 and for the year as a whole for each State.

Monthly Weather Review, [March–April, 1929] (*U. S. Mo. Weather Rev., 57 (1929), Nos. 3, pp. 85–126, pls. 14, figs. 7; 4, pp. 127–178, pls. 14, figs. 16*).—In addition to detailed summaries of meteorological and climatological data and weather conditions for March and April, 1929, and bibliographical information, notes, abstracts, and reviews, these numbers contain the following contributions:

No. 3.—The Climatic Record of Honduras (illus.), by N. A. Bengtson (pp. 85–90); Weather Abnormalities in the United States (illus.), by A. J. Henry (pp. 90–94); Notes on Line Squalls, by C. G. Andrus (pp. 94–96); Evaporation from Rain Gages, by H. G. Carter (p. 96); Coast Fogs and Radiobeacons, by W. E. Hurd (pp. 96, 97); Tornadoes in Kansas, by S. D. Flora (pp. 97, 98); Ångström on Recording Solar Radiation: A Study of the Radiation Climate of the Sur-

roundings of Stockholm, by H. H. Kimball (pp. 98, 99); and C. E. P. Brooks and W. Quennel on the Influence of Arctic Ice on the Subsequent Distribution of Pressure over the Eastern North Atlantic and Western Europe (illus.), by A. J. Henry (pp. 99–102).

No. 4.—Projections for World Maps (illus.), by C. F. Marvin et al. (pp. 127–136); Wet and Dry Northers (illus.), by I. R. Tannehill (pp. 136–142); A Critical Test of the Planetary Hypothesis of Sun Spots (illus.), by D. Alter (pp. 143–146); Low Relative Humidity in Oregon, by C. I. Dague (pp. 146–153); Cloud Height According to Direction of Motion (illus.), by A. F. Piippo (p. 154); Tornadoes in Arkansas, April, 1929, by H. S. Cole (pp. 155, 156); Tornadoes in Wisconsin, April, 1929 (illus.), by W. P. Stewart (p. 157); Hail April 21, 1929, in Kentucky, Illinois, and Louisiana (illus.), by J. L. Kendall, W. E. Barron, and R. A. Dyke (pp. 157, 158); and Squalls with Rising Barometer at Roseburg, Oregon, by E. H. Fletcher (pp. 158, 159).

SOILS—FERTILIZERS

[Soil and fertilizer studies in Rhode Island] (*Rhode Island Sta. Rpt. [1928], pp. 43–45, 46, 48, 49, 51*).—This is a continuation of previous work (E. S. R., 59, p. 615).

Organic matter for the soil.—Of four winter legumes used as green manure crops, red clover made the best stand and resulted in the best yield of potatoes the following spring, when a fertilizer mixture was applied with a relatively low proportion of nitrogen on the assumption of a fixation of nitrogen by the legumes. Other experiments with green manures and cover crops are also noted briefly.

Efficiency of fertilizers and manures.—With nitrogen as the limiting factor, corn following grass sod yielded 65 bu. an acre; 28 lbs. of nitrogen to the acre increased the yield to 78 bu.; and 56 lbs. of nitrogen to 88 bu. Decreasing the ration either of potassic or of phosphatic fertilizer components had little effect upon the yields, however. The slow availability of the less soluble phosphatic materials was clearly demonstrated. Manganese on nearly neutral soils was shown to be a limiting factor, and increases resulted from its application as sulfate to early and late beets and spinach to the extent of from 21.4 to 35.8 per cent.

Modification of sour soil.—Spinach, oats, rape, and endive produced better on the plats receiving the greater applications of lime, the spinach and rape showing larger responses to liming than did the oats. In all four of the crops the depression in yield resulting from insufficient liming was most marked when the phosphate supply also was low.

Soil nitrate nitrogen.—An attempt was made to regulate nitrate concentrations for the comparison of the effects of optimum concentrations of nitrate nitrogen in the soil as determined from previous work with suboptimum concentrations. The experiment was successful in the case of lettuce, which yielded about 40 per cent more on soil carrying approximately 15 parts per million of nitrate nitrogen than did a soil showing a nitrate nitrogen concentration but slightly below 10 parts per million. The data for other crops were not inconsistent with previous results.

Nitrates in plant solutions.—Nitrate levels in general were again found in this year's work to follow the fertilization rates. High nitrate concentrations in tomatoes and in the juice of cabbages were found during periods of low soil nitrate concentrations. Applications of soluble nitrates during the period are considered to furnish the probable explanation of this condition, since the applications of soluble nitrates were shown not to have increased the nitrate concentration in the soil and leaching had not taken place.

Upon approaching maturity each crop showed a decreased nitrate concentration accompanied by decreased concentrations of nitrates in the soil.

Soil ammonia nitrogen.—"In well fertilized market-garden soil with considerable organic matter, a nearly neutral reaction and sufficient water, the accumulations of ammonia may be summarized as follows: Of 130 determinations 16 per cent were of magnitude greater than 10 parts per million of nitrogen; 7 per cent were between 5 and 10 parts per million, leaving 77 per cent of the results below 5 parts per million. Only once in 12 trials was an application of 15 to 20 lbs. per acre of ammonia nitrogen (equivalent to about 10 parts per million of nitrogen) reflected as an increase in ammonia nitrogen from 3 to 5 days later."

On other areas, however, where the reaction was only slightly more acid than in the market-garden soils and the general fertility very satisfactory, with the possible exception of low organic matter, a considerable proportion of the ammonia nitrogen from large applications of sulfate of ammonia in the drill remained unchanged to the middle of July.

Total moisture in plant tissue.—The greatest coefficient of variation was found to be only 6 per cent with corn over the entire growing season. Considering this, together with a maximum difference of 7 per cent found when plants were actually wilting under glass, it is concluded that the error introduced by fluctuations in moisture within the plant is not sufficient to affect materially the determinations of inorganic nutrient elements in the plant solution.

Aluminum in crops and soils.—"After analysis of seedlings of turnips, cabbage, sorghum, rye, redtop, timothy, oats, buckwheat, and millet, each grown in solutions containing various amounts of aluminum, the last three plant species were selected as most likely to show correlation between active aluminum in the soil and that absorbed by a plant."

Soil organic matter.—Lettuce, beets, onions, carrots, and celery were grown in Wiley pots. Three varying amounts of decayed rye straw were added to supply organic matter and three moisture levels, 15, 20, and 30 per cent, were maintained by daily corrections by weight. From the dry weight yields celery appears to be the most sensitive, followed by carrots, beets, lettuce, and onions in order of sensitivity. All the above crops gave the best growth with the higher soil mositure content.

Intercrop effects.—With the addition of sufficient chemicals to the leachings from certain field plats to make complete nutrient solutions Cos lettuce seedlings were grown. Leachings from soil where rye was plowed in as a cover crop followed by a crop of lettuce caused greater depressions in growth of lettuce in solution culture than after turnips, clover, and soybeans. This corresponded to the field growth of lettuce under the same conditions. Treatment of the leachings with carbon black apparently took out a portion of the toxic principle as was shown by increased growth in treated solutions.

[Soil Survey Reports, 1923 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1923, Nos. 4, pp. 91–122, fig. 1, map 1; 5, pp. 123–152, pls. 4, fig. 1, map 1; 6, pp. 153–175, fig. 1, map 1; 8, pp. 201–245, pls. 4, fig. 1, maps 2; 10, pp. 271–305, fig. 1, map 1; 40, pp. 1315–1373, pls. 2, fig. 1, map 1; 41, pp. 1375–1422, fig. 1, map 1; 42, pp. 1423–1469, fig. 1, map 1; 43, pp. 1471–1504, fig. 1, map 1*).—The reports of the soil surveys of the 1923 series here noted deal with the soils of Jenkins and Dooly Counties, Ga., in cooperation with the Georgia State College of Agriculture; Rockwall County, Tex., in cooperation with the Texas Experiment Station; Maury County, Tenn., in cooperation with the Tennessee Geological Survey; the Las Vegas area of

Nevada; Monroe and Pierce Counties, Wis., in cooperation with the Wisconsin Geological and Natural History Survey and the University of Wisconsin College of Agriculture; and Adams and Platte Counties, Nebr., in cooperation with the University of Nebraska.

No. 4, by E. D. Fowler and J. M. Snyder.—This report for Jenkins County, Ga., has been noted from the unnumbered edition (E. S. R., 55, p. 415).

No. 10, by S. W. Phillips et al.—Dooly County is an erea of 258,560 acres in south-central Georgia, ranging in topography from gently rolling to steeply rolling and hilly. The higher portions of the county are well drained, except for small ponds and the wide creek swamps. In other parts of the county large ponds are frequent, together with poorly drained flats and seepy areas on the slopes. "The low terraces . . . contain large areas of swamp."

Of the 14 series of 20 types mapped and described, but two are of important areal extent, namely, Norfolk sandy loam amounting to 19.4 per cent and Tifton sandy loam 19.0 per cent, with 6.4 per cent in swamp.

No. 5, by H. V. Geib.—Rockwall County constitutes an area of 95,360 acres in northeastern Texas, the topographic features being those of a part of the valley of the East Fork River, undulating to steeply sloping country including terraces, and a section of rolling uplands. The valley portion of the area is described as flat and subject to periodic overflow.

The most extensive soil types noted are Houston clay, 38.1 per cent of the total area of the county, Houston black clay 28.1 per cent, and Trinity clay 18.0 per cent. In all, 5 series including 8 types are listed.

No. 6, by J. H. Agee and J. A. Kerr.—Maury County, south-central Tennessee, consists of 395,520 acres divided into the basin or low section and a Highland Rim division. "Between these divisions the slopes are characteristically steep, in places having so many rock ledges as to be unfit for cultivation." In the Central Basin "large areas which have not been eroded show a flat, often poorly drained surface. . . . On the edges of the rim, approaching the Central Basin, erosion has developed steep, precipitous slopes and many ridges."

The larger soil areas noted are Maury silt loam 24.4 per cent, Baxter gravelly loam 14.1, and 10.1 per cent of rough, stony lands. A total of 18 types are classified under 9 series.

No. 8, by E. J. Carpenter and F. O. Youngs.—This survey of the Las Vegas area, Nevada, has previously been noted (E. S. R., 56, p. 316).

No. 40, by W. J. Geib et al.—Monroe County, Wis., lies somewhat southwest of the center of the State and has an areal extent of 591,360 acres inclusive of three physiographic divisions—a dissected plateau in the southern part of the county, in the northwestern section broad, gently rolling valley plains bordered by hills, and in the northeastern section an undulating plain with occasional isolated hills.

The more extensive soils mapped and described are Boone fine sand 14.9 per cent, Boone silt loam 13.5 per cent, and Dubuque silt loam 10.8 per cent of the area surveyed. The rough, stony lands constitute 16.6 per cent of the area and peat 6 per cent, the latter furnishing the agriculturally important cranberry bogs. A total of 13 soil series classifiable into 29 types was found.

No. 43, by W. J. Geib et al.—Pierce County, Wis., lies at the western boundary of the State and possesses an areal extent of 375,040 acres of somewhat dissected rolling plain. "The numerous tributaries of Mississippi and St. Croix Rivers reach into all parts of the county and drain it thoroughly."

Clinton silt loam, 41.4 per cent of the total area surveyed and described as for the greater part highly improved, is the most extensive of the 20 types, here assigned to 13 series, which were found in the survey reported. Lindley silt

loam is next in areal importance with 22.6 per cent, and 12.1 per cent is smaller areas of river wash, rough, stony land.

No. 41, by F. A. Hayes and D. F. Hyde.—Adams County, Nebr., in the south-central part of the State, has an area of 361,600 acres which forms part of a gently undulating plain but slightly dissected and possessing a very gentle southward slope. Drainage is provided mainly by the Little Blue River and its tributaries but in part also by the Big Blue and Platte Rivers and their tributaries. The county generally is well drained.

Crete silt loam, 34.3 per cent of the total area of the county, is the most extensive of the 21 types of 13 series here mapped and described, Holdrege silt loam following with 16.4 per cent and Hastings silt loam with 14.5 per cent. Miscellaneous material is represented by 0.7 per cent of dune sand.

No. 42, by L. S. Paine et al.—Platte County, Nebr., comprises an area of 430,720 acres in the east-central part of the State, and possesses the topographic features of an upland plain in the northern three-fifths of the county and a lower, from flat to undulating, valley designated the Platte Plain. The county in general is provided with ample drainage.

The soils of Platte County were mapped and classified in the survey here reported in 14 series inclusive of 27 types, of which Marshall silt loam 25.4 per cent of the total area of the county, Marshall silty clay 16.9 per cent, and Hastings silt loam 11.6 per cent are the more extensive. There is 1.6 per cent of dune sand.

[Soil Survey Reports, 1924 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1924, Nos. 19, pp. 52, fig. 1, map 1; 20, pp. 36, fig. 1, map 1; 21, pp. 31, fig. 1, map 1; 22, pp. 25, fig. 1, map 1*).—These reports deal with the surveys of Wichita County, Tex.; Butler County, Nebr.; Summers County, W. Va.; and Muskegon County, Mich.

No. 19, by W. T. Carter et al.—Wichita County is an area of 624 sq. mi. at the northern border of Texas, with which are included in the present survey 16 sq. mi. in Tillman County, Okla., and 3 sq. mi. in Cotton County, Okla., bringing the total survey area to 411,520 acres. The topography is that of a smooth, rolling plain, and drainage is provided exclusively by the Red River.

The 26 types found in the present survey are classified into 9 series, Foard very fine sandy loam 15.5 per cent and Vernon clay loam 15.2 per cent covering the largest individual aggregate areas among the classified types. The non-agricultural soils listed unclassified consist of river wash, rough broken lands, rough stony lands, and dune sand, totaling 7.7 per cent of the entire area surveyed.

This survey was made in cooperation with the Texas Experiment Station.

No. 20, by A. W. Goke and G. E. Bates.—Butler County, Nebr., in the eastern part of the State, includes an area of 376,320 acres, of which about two-thirds is smooth to gently undulated upland plain little altered by erosion, the remainder of the area including some rougher and more hilly country. Drainage is provided both by the Platte and by the Big Blue Rivers and by tributaries of these streams.

The highly productive Marshall silt loam, 46.8 per cent of the total area, is the most extensive of the 23 types here classified as 18 series. Hastings silt loam follows with 13.6 per cent.

This survey was made in cooperation with the University of Nebraska.

No. 21, by J. A. Kerr.—Summers County consists of 232,320 acres of lands deeply cut by the New and Greenbrier Rivers in southern West Virginia. The major part of the county "consists of a series of steep slopes bounding the

narrow valleys of a dendritic drainage system separated by narrow watershed ridges."

Upshur silt loam 29.1 per cent, Dekalb silt loam 20.7, Meigs silt loam 14.0, and Meigs stony silt loam 11.1 per cent of the total area of Summers County are the more extensive among a total of 20 types here included under 12 series. An aggregate area amounting to 1.6 per cent of Summers County is listed as rough stony land unclassified, in addtiion to which it is noted that certain of the classified types are in many places too stony or too steep for agricultural use other than as pasture or forest lands.

This survey was made in cooperation with the West Virginia Geological Survey.

No. 22, by L. C. Wheeting and A. E. Matthews.—Muskegon County, Mich., is located in the western central part of the State and has an areal extent of 328,960 acres. The surface features comprise level lands, rolling country, and comparatively hilly areas. Drainage is provided for the most part by three river systems but in some areas only by smaller streams flowing directly to Lake Michigan.

In the present survey, made in cooperation with the Michigan Experiment Station, 19 soil types were recognized and are here mapped and described as 17 series. Plainfield loamy sand has the largest individual aggregate area, 42.1 per cent, of the total area of the county, while Saugatuck sand totals 14.2 per cent.

Magnesium and calcium in zeolitic soils, J. F. Breazeale (*Arizona Sta. Tech. Bul. 26 (1929), pp. 37–65, fig. 1*).—A common ion in solution interfered with base replacement by retarding ionization. Calcareous magnesium zeolite soils were similar in behavior with respect to base replacement by magnesium and calcium salts to calcareous calcium zeolite soils. Practically the same relation was found to exist between barium and either calcium or magnesium as between magnesium and calcium. Calcium present in zeolitic soils as calcium carbonate took part in base replacement reactions as readily as if present in the form of more soluble salts, but magnesium carbonate in the form either of magnesite or of dolomite did not appear to take part readily in base replacement reactions except in the presence of carbon dioxide. In the case of the treatment of soils with dilute hydrochloric acid a breakdown of zeolitic compounds appeared to take place, as well as a replacement of exchangeable base by hydrogen, the treatment of such soils with a solution containing a replaceable base leading apparently to the opposite reaction, under which conditions the extent of the building up of zeolitic compounds was found to depend largely upon the pH value of the percolating solution.

Experimental methods and the data obtained are given in some detail.

The botanical composition and morphological features of "Highmoor" peat profiles in Maine, A. P. Dachnowski-Stokes (*Soil Sci., 27 (1929), No. 5, pp. 379–388, fig. 1*).—The paper presents a somewhat detailed account of the botanical species found and the degree of decomposition observed in the peat profiles of the Lewiston or Garcelon heath at Lewiston, Me., the Veazie heath in the Orono area, and the Denbo heath near Cherryfield, Me.

In surface aspects the three areas discussed were found to show light colored poorly decomposed and dark colored partially decomposed sphagnum moss peat phases varying in thickness from 5 to 17 ft., with a water table from 3 to 10 in. below the surface. Below the sphagnum a layer of "moderately decomposed" woody peat was found, and in the deeper depressions this in turn was found underlain by a fibrous reed sedge peat over a sedimentary peat and an argillaceous to sandy mineral substratum. "Stratigraphically the peat profiles represent

the conifer heath-sphagnum moss series and the sedimentary-reed sedge-conifer heath-sphagnum moss series."

The peat layers were found anaerobic throughout, with a very slow present rate of decomposition. "In terms of stage of development (toward peat soil formation) the areas may be grouped into the category of immature, virgin peatlands, predominantly botanical in character."

Plant and soil relations at and below the wilting percentage, O. C. Magistad and J. F. Breazeale (*Arizona Sta. Tech. Bul. 25 (1929), pp. [3]+36, figs. 4*).—A discussion, largely theoretical, of plant and soil moisture relationships at moisture percentages approximating the wilting point leads to a considerable number of conclusions among which are the following:

The soil solution being defined as including all of the moisture, available or not available, in the soil, there is a tendency toward a state of equilibrium between the soil and the soil solution.

At all percentages of soil moisture, from optimum to an air-dry condition, there is a film of water surrounding each soil particle regardless of its size.

Soils swell or shrink chiefly because of an increase or diminution in the *thickness of the gellike coat which the larger soil grains possess.* We can consider the walls of each vesicle in the gel as being covered with a film of water, or the nucleus of each micelle of the gel as being surrounded by a water envelope.

The amount of gas absorbed by a soil is a function of the nature of the soil particle, the area of the surface, and the water content of the soil. Increasing the water content decreases the amount of gas absorbed, with a consequent swelling of the soil if the liberated gas does not all escape.

The forces acting upon water in soils are adhesion, cohesion, and gravitation. The last is relatively important at high moisture contents, but the force of adhesion is by far the greatest at low water contents. Water in a soil always arranges itself so as to be in equilibrium with these three forces.

In soils above the wilting percentage the rate of water intake by plants is sufficient to maintain turgor. As the soil moisture content decreases, the rate of water movement decreases also, and when this rate first becomes insufficient to maintain turgor wilting takes place in plants not provided with water storage tissues. The decreasing rate of water movement, or water intake, is caused by two factors. First the force gradient becomes less, that is, the soil holds the remaining water with an increasing force, which force gradually approaches the force of the plant for water. Second, the level of this force gradient is gradually increasing, causing a decreasing rate of water movement.

The innermost layers of water are held to soil particles with very great force. Each succeeding layer is held with a decreasing force. A measure of the magnitude of the forces can be obtained by freezing point studies. In such determinations the force of freezing must exceed the force of adhesion in order to produce freezing. From this it follows that very low temperatures are required to freeze the innermost layers of water.

In the inner layers of the soil film, nutrient materials are the most concentrated. The enormous attractive force of the soil particle for water at the wilting percentage may prevent the absorption of water by the plant, but it may not interfere with the absorption of nturient material. A surface soil that is maintained at the wilting percentage during a great part of the growing season may furnish a feeding ground for plants, although it may contain no available moisture.

The rapidity of absorption of plant food is largely a function of the concentration of the nutrient solution.

At the wilting percentage there is an equilibrium between the plant and the soil with respect to moisture. To a certain extent the plant is probably able to maintain this equilibrium by exuding water from its roots whenever the soil moisture is reduced below the wilting percentage.

"We may look upon the wilting percentage of soils as the soil-water-content when the rate of water intake is just sufficient to maintain turgor. At this moisture content the pull of the plant for water slightly exceeds the pull of the soil for water. The water is held by the soil with a pull of from six to ten atmospheres, or thereabouts. The amount of water held by a soil with this force can be determined by freezing-point methods as well as vapor-pressure methods. These, then, are new indirect methods for the determination of the wilting percentage in soils. The static method in which the soil is placed in a container over a solution of the proper relative vapor pressure (approximately 99.6 per cent relative vapor pressure) is inaccurate because of the great errors due to slight changes in temperature. The dynamic method in which the soil is brought into equilibrium with air having the proper relative vapor pressure promises to be more accurate than the other vapor-pressure method."

Root development and soil moisture, J. P. Conrad and F. J. Veihmeyer (*Hilgardia [California Sta.], 4 (1929), No. 4, pp. 113–134, figs. 3*).—Data here discussed were taken to indicate the extraction of moisture, under rows of grain sorghum, in successive zones, the extraction appearing progressive when no significant moisture additions occurred during the growing season. It was inferred from the results obtained that the ratios of the soil moisture contents to the corresponding moisture equivalents might be used to indicate the root development, the results of adequate moisture determinations made at suitable intervals indicating "with a fair degree of accuracy the presence or absence of roots of plants growing on the soil tested."

It was further stated that "a correlation has been shown to exist under the conditions of this study between the amount of roots and the extent to which the soil has been dried by root activity. The writers reason that if the soil is wet at the beginning of the growing season to the full depth to which roots of plants would normally penetrate, subsequent additions of water by rain or irrigation, unless adverse conditions for growth are brought about thereby, can have but little influence on the extent of the root system developed."

Relative rates of decomposition of corn and kafir stubble, P. L. Gainey (*Jour. Amer. Soc. Agron., 21 (1929), No. 3, pp. 323–343, figs. 7*).—From the results presented in this contribution from the Kansas Experiment Station it is concluded that apparently there is present in kafir a small proportion of "carbonaceous material somewhat more easily oxidizable by microorganisms" than that found to exist in corn. This substance was observed to bring about a development of microorganisms temporarily more rapid in the case of the kafir than in that of the corn, this effect being considered as "probably resulting in a somewhat more rapid assimilation of soluble nitrogen." "Such material is probably soon exhausted," the decomposition rates of the two materials having run practically parallel, and, "if any further influence is exerted upon the nitrate content of the soil it is a stimulation, rather than a retardation, in nitrate accumulation by the kafir as compared to corn residues."

Chemical and microbiological principles underlying the transformation of organic matter in the preparation of artificial manures, S. A. Waksman, F. G. Tenney, and R. A. Diehm (*Jour. Amer. Soc. Agron., 21 (1929), No. 5, pp. 533–546*).—According to this communication from the New Jersey Experiment Stations, straw and other farm residues in general use for composting consist of 60 per cent or more of celluloses and hemicelluloses (which were

found to undergo rapid decomposition in the presence of sufficient quantities of nitrogenous and mineral substances); lignins (from 15 to 20 per cent), more resistant to decomposition than the celluloses and hemicelluloses, so that they accumulate gradually; water-soluble substances amounting to from 5 to 12 per cent and subject to rapid decomposition; from 1.2 to 3.0 per cent of protein which usually increases gradually in amount as decomposition proceeds; and finally, the mineral portion or ash content. The decomposition processes involved in the composting were found to "consist largely in the disappearance of the celluloses and hemicelluloses which make up more than 80 per cent of the organic matter which is undergoing decomposition in the process of formation of artificial manures.

"These polysaccharides can not be used as direct sources of energy by nitrogen-fixing bacteria, and their decomposition depends entirely upon the action of various fungi and aerobic bacteria. In the process of decomposition of the celluloses and hemicelluloses, the microorganisms bring about the syntheses of microbial cell substance. This may be quite considerable, frequently equivalent to a fifth or even more of the actual organic matter decomposed. To synthesize these large quantities of organic matter, the microorganisms require large quantities of available nitrogen and phosphorus and a favorable reaction. The nitrogen and phosphorus are used for the building up of the proteins and nucleins in the microbial cells. Since there is a direct relation between the celluloses decomposed and the organic matter synthesized, it should be expected also that there would be a direct relation between the cellulose decomposed and the amount of nitrogen required. As a matter of fact, for every 40 or 50 parts of cellulose and hemicellulose decomposed 1 unit of available nitrogen has to be added to the compost.

"As the plant residues used in the preparation of 'artificial manure' are poor in nitrogen, available inorganic nitrogen must be introduced for the purpose of bringing about active decomposition. This explains the increase in the protein content of the compost accompanying the gradual decrease of the celluloses and hemicelluloses.

"In general, artificial composts can be prepared from plant residues of any chemical composition so long as the nature of these residues and of the processes involved in their decomposition are known. By regulating the temperature and moisture content and by introducing the required amounts of nitrogen, phosphorus, potassium, and calcium carbonate, the speed of decomposition and the nature of the product formed can be controlled."

The production of artificial manure from oats straw under control conditions, P. E. Brown and F. B. Smith (*Jour. Amer. Soc. Agron.*, *21* (*1929*), *No. 3, pp. 310–322*).—The composting of oat straw with ammonium sulfate and lime, with sodium nitrate, or with urea under greenhouse conditions and for a period of 5 months was found in the investigation reported in this contribution from the Iowa State College to bring about a rapid decomposition. Under optimum moisture and temperature conditions a good artificial manure was found to be produced in from 5 to 9 months from straw to which had been added 1 per cent or less of nitrogen. However, "with additions smaller than 1 per cent the treatment with ammonium sulfate and lime seemed to be preferable." Also, when ammonium sulfate with calcium carbonate or urea were added with straw to sand in the laboratory, the decomposition as measured by carbon dioxide production was found very rapid, but other sources of nitrogen were less effective, and cyanamide depressed the decomposition rate.

In the field "decomposition was more rapid in various compost mixtures than with straw alone," but in the open the decomposition was less rapid than

in the greenhouse, so that no great differences were observed as between composts of different make-up.

"The artificial manures produced in the greenhouse with two exceptions showed as great or greater effect than farm manure on the nitrate content of a virgin Carrington loam. The nitrifying power of the soil was stimulated by practically all of the mixtures; but to a less extent than by manure in the early days following treatment, although later the effects were greater than those brought about by manure. In some cases the nitrate-assimilating power of the soil was stimulated by the artificial manures but not to a large extent. The effects, however, were very similar to those brought about by farmyard manure. The production of an artificial manure which will have similar beneficial effects to farm manure seems quite possible."

Amounts of fertilizer and manure required for maintenance of fertility for vegetable production, T. H. White and V. R. Boswell (*Maryland Sta. Bul. 309 (1929), pp. 429–446*).—Experiments carried on from 1915 to 1927, inclusive, with late cabbage, early and late potatoes, peas, sweet corn, spinach, and tomatoes indicated that if manure is available at low cost, or produced on the farm, there is no question as to its value. If it must be bought at a high price and hauled considerable distances, it appears that under conditions similar to those described for this experiment, it can be replaced more profitably by crop residues and commercial fertilizer."

Tobacco as an indicator plant in studying nutritional deficiencies of soils under greenhouse conditions, M. F. Morgan (*Jour. Amer. Soc. Agron., 21 (1929), No. 2, pp. 130–136, figs. 3*).—This is a contribution from the Connecticut State Experiment Station.

Tobacco of a Turkish variety was found to furnish a satisfactory solution of the difficulties encountered with many field crops when grown in greenhouse pots. Under conditions worked out at the station, it showed significant differences both in total yield and in character of growth when one or more of the nutrient elements was omitted from the fertilizer ration, while neither insects nor plant diseases caused trouble. The general technic is as follows:

"The surface soil is collected from a field which has not been limed or fertilized for several years. Opportunities for obtaining such a condition are found in fields which have been in grass sod for many years and have become reduced to the normal productive level of the soil, unsupplemented by fertilizer or lime treatment. The soil is screened and mixed thoroughly, and a series of 16 pots are filled with soil. Precipitated chalk is added to all limed pots at rates equal to 1.5 times the Jones limestone requirement. The fertilizer treatments are added in solution. Nitrogen is applied as urea, equivalent to 120 lbs. per acre. Phosphorus is added as orthophosphoric acid (85 per cent) equivalent to 1,000 lbs. of 16 per cent superphosphate per acre. Potassium as potassium acetate equivalent to 240 lbs. of muriate of potash per acre is applied. The moisture content is made up to optimum, and the pots are planted with Turkish tobacco seedlings of uniform size and showing about five leaves, one plant per pot. Plants which develop abnormally during the first 2 or 3 weeks are reset." There were obtained in this way in practically all cases very uniform duplicates.

Some results of soil tests carried out by this method on 24 soils illustrate the success of the procedure.

Effects of synthetic nitrogen and concentrated fertilizers on cotton and sweet potatoes, J. J. Skinner, C. B. Williams, and H. B. Mann (*North Carolina Sta. Bul. 266 (1929), pp. 40, figs. 6*).—Descriptions are given of 18 of the newer nitrogenous fertilizers, and tests made at various points in the State in cooperation with the U. S. D. A. Bureau of Chemistry and Soils are reported.

In general the authors were not able to obtain as good results with concentrated fertilizers as with ordinary commercial fertilizers, under the conditions of the tests reported, either with cotton or with sweetpotatoes. "Further study is required before their general use can be recommended for sweetpotatoes on soils of this character."

Ammonium chloride appears to have been the disturbing factor in at least one of the concentrated mixtures.

It appeared desirable to use synthetic and other mineral nitrogenous salts in conjunction with organic sources of nitrogen.

Some effects of manganese sulfate and manganese chloride on nitrification, D. H. Nelson (*Jour. Amer. Soc. Agron., 21 (1929), No. 5, pp. 547–560*).—The results of a study of the effect upon nitrification of the sulfate and chloride of manganese are presented in this contribution from the Iowa State College. The soils used were Carrington and Webster loams, and dried blood and ammonium sulfate were applied as sources of nitrogen. Comparisons were made of the behavior with respect to nitrification of the soils treated with manganese salts with the same soils treated with quantities of sulfates and of chlorides sufficient to give the soils a concentration with respect to these negative ions the same as that occurring in the soils carrying the manganese salts.

"The results reported show that manganese salts may stimulate or depress nitrification, but the degree of stimulation or depression does not follow regularly with the increase in amount of manganese salts applied. There was no particular concentration of manganese which proved stimulating in all cases, nor were the largest amounts applied always the most toxic. However, the toxic effects were more regular than the stimulating effects, usually increasing with the larger applications.

"The effects of the sulfate and chloride solutions were similar to those brought about by the manganese sulfate and chloride, differing chiefly in degree. The solutions were in all cases less toxic in the large applications than were the manganese salts in the same concentrations. However, there was no regular stimulation nor toxic effect with the small applications."

It was found, further, that lime distinctly reduced the toxic effect upon nitrification exerted by manganese. "This is undoubtedly due to the change in reaction, for it is generally true that a basic soil has a higher nitrifying power than a similar acid soil. The sand and solution tests were not extensive enough to warrant general conclusions; however, it is clear that manganese treatments bring about little or no stimulation in nitrification, at least as far as tested in these experiments."

Comparisons of soil liming materials, A. T. Wiancko, G. P. Walker, and S. D. Conner (*Indiana Sta. Bul. 329 (1929), pp. 23, figs. 7*).—A description of a number of liming materials is followed by an account of comparative experiments at Wanatah and North Vernon.

Ground limestone and marl were found the most practical materials for the correction of soil acidity in Indiana. Limestone both of the 50-mesh and 10-mesh grade of fineness produced as large crop increases both in the first and in succeeding years as did hydrated lime, and the same result was obtained also from the application of marl. The ground limestone is described as easily obtainable at from one-third to one-fifth of the cost of hydrated lime. It was further found that the 10-mesh grade of ground limestone was as effective as was the finer material. The 4-mesh limestone screenings were less effective than the 10-mesh during the first few years but could satisfactorily be used if in larger quantities as a rapidly increasing delayed effect was observed after a few years.

Hydrated magnesian lime proved fully as effective as pure calcium lime. It was noted that "with the moderate applications the lime has affected the acidity of the soil only in the surface layer," and that "the extremely heavy applications of ground limestone have produced no ill effects and there seems to be no danger of overliming these soils."

Effect of lime materials on the outgo of sulphur from Hagerstown silt loam soil, W. B. Ellett and H. H. Hill (*Jour. Agr. Research* [*U. S.*], 38 (1929), *No. 12, pp. 697–711*).—The determination of the drainage of sulfur compounds from Hagerstown silt loam, as here reported at considerable length, had the stated objective of ascertaining the losses from additions of sulfur and the changes resulting from the addition of organic matter and liming materials, was carried out at the Virginia Station, and presents, following a review of preceding research work on the subject and a description of the lysimeter equipment of the station, an account of analyses from which were drawn the conclusions stated.

The application of liming material did not greatly increase the sulfur content of the leachings, but appeared to stimulate the biological sulfur-transforming processes. Liming materials mixed with 12 tons of red clover hay were not found to have any material effect upon the quantity of sulfur compounds leached. The growing of millet and clover appears to have shown a tendency to lessen the drainage of sulfur, that added by rainfall, together with the sulfur content of the stubble, having restored, apparently, the normal sulfur content of the soil shortly after the removal of the crop. Clover residues are stated not only to have increased plant growth but also to have added to the soil, in conjunction with the rainfall, a quantity of sulfur sufficient for a second crop of millet, the bare soil having lost, according to the findings reported, 2.19 lbs. more of sulfur per acre than did that containing the millet stubble. The subsoil exerted an apparent fixing effect upon the sulfur content of the rain water.

Symposium on lime (*Jour. Amer. Soc. Agron.*, *21* (*1929*), *No. 4, pp. 381–403, fig. 1*).—The four papers here noted were presented at the meeting of the American Society of Agronomy held in Washington, D. C., November 22, 1928.

1. *The portable soil laboratory and the Ohio method of testing soils for acidity*, E. Jones (*pp. 381–384*).—*This is a contribution from the Ohio State* University, in which a description is given of a portable laboratory bench arranged for the examination of soil samples and capable of being carried about, ready for almost immediate use, in a light truck. The thiocyanate test for soil acidity and a color test for phosphoric acid are noted as having been included in the examination, and some account is given of the practical working of the system in Ohio.

2. *Lime surveys for use in Illinois and testing for lime requirement*, C. M. Linsley (pp. 385–391).—This is an account, contributed from the Illinois University, of the practical results of instruction of farmers in the use of the thiocyanate acidity test and the mapping of farms with reference to a 4° scale of acidity.

3. *The Kentucky marl beds as a source of lime material*, S. C. Jones (pp. 392–398).—On soil showing a pH value of about 5.13, marl having a neutralizing value equivalent to that of 45 per cent of calcium carbonate was compared with ground limestone at an application rate of the equivalent of ½ ton of pure limestone to the acre at the Princeton, Ky., Substation, with the result that less clover hay was obtained from the limestone treatment than from the marl applications. Mechanical analyses showed the marl to contain more fine material than a comparatively very well ground limestone. The nature

and extent of the marl resources of the State are discussed, as is also the problem of a method for the distribution of the marl in the field.

4. *The development of equipment for dredging marl from the Michigan lakes*, L. F. Livingston (pp. 399–403).—It is noted in this contribution from the Michigan State College that, although marl is a mixture of calcium carbonate with clay, the Michigan marl supplies are predominantly calcium carbonate and of a quality such that 1.25 cu. yds. of 85 per cent marl is equivalent to 1 ton of the best grade of ground limestone. A brief account of the mode of formation of the marl deposits of such glaciated areas as those of Michigan is given, followed by a description of equipment shown by the Michigan Station to be satisfactory for the handling and utilization of the marl.

AGRICULTURAL BOTANY

The evolution of substances in the plant world and the fundamental laws of biochemistry [trans. title], S. Ivanow (*Ber. Deut. Bot. Gesell.*, *44* (*1926*), *No. 1*, *pp. 31–39*).—Chemical, morphological, and other facts which are set forth in this article are epitomized in three statements which are presented as laws fundamental in biochemistry.

Every species retains, during the continuance of given conditions, the capability to produce those characteristic materials which constitute its physiological-chemical criteria.

Every species shares its physiological-chemical characters with those forms which are connected with it genetically. The closer the genetic relationship, the greater is the number of characters common to the related species.

With further remove, as regards relationship, appear new materials, which show relatively simple relationships to the more fundamentally characteristic substances. The physiological-chemical characters of plants form the basis for evolution.

Structure of plant compounds and solubility, R. H. Carr (*Science*, *69* (*1929*), *No. 1789*, *pp. 407*, *408*).—In carrying on work in plant analysis, the author found that cold formic acid dissolved not only sugars but also dextrin, starch, inulin, glycogen, agar, chlorophyll, glucosides, etc., as well as some of the plant pigments combined or associated with glucosides. When starch was dissolved in formic acid a clear sirupy liquid was formed. Spoehr reported that formic acid could be produced by the action of ultra-violet light on carbonic acid and water, and on further exposure a nonvolatile sirup was produced (E. S. R., 53, p. 26). The author concludes that since formic acid can be produced as above and as it is a decomposition product of certain carbohydrates, the formic acid theory of photosynthesis is given additional support.

Chemistry of chlorophyll [trans. title], A. von Lingelsheim (*Ber. Deut. Bot. Gesell.*, *44* (*1926*), *No. 8*, *pp. 502–505*).—This is a brief account of study by the author on the colorants in fresh leaves of *Phaseolus coccineus*, with a comparative review of the related work and views of some others, more particularly of Willstätter and his associates, some of whose work has been noted (E. S. R., 30, p. 311; 31, p. 427).

Metabolized protoplasmic layers in plant cells [trans. title], W. W. Lepeschkin (*Ber. Deut. Bot. Gesell.*, *44* (*1926*), *No. 1*, *pp. 7–14*).—Argument is presented which is claimed to rest partly upon data and conclusions set forth in the present author's own work (E. S. R., 53, p. 309), and which is considered to be opposed to views of other authors who are named. The character, structure, and functioning of cell protoplasmic layers is dealt with as noted in *Spirogyra setiformis*, *Tradescantia* (*Rhoeo*) *discolor*, *Urtica dioica*, *Hydrocharis morsus ranae*, and *Elodea canadensis*.

Protoplasm and chloroplasts in Bryopsis plumosa [trans. title], W. W. LEPESCHKIN (*Ber. Deut. Bot. Gesell.*, *44* (*1926*), *No. 1*, *pp. 14–22*).—Referring to basal conceptions and conclusions in the publication above noted, the author deals herein with characters and behaviors in considering, as regards *B. plumosa*, the structure of the protoplasm, mechanical coagulation, water of protoplasm, vital coloration, and chloroplasts.

Stimulation [trans. title], G. GASSNER (*Ber. Deut. Bot. Gesell.*, *44* (*1926*), *No. 6*, *pp. 341–367*).—The author gives an account and review of literature as far back as 1845 bearing upon phases of stimulation in plants, with an outline of the present state of the inquiry.

On the relation between cell-division and elongation in the root of Vicia faba, H. KOJIMA (*Jour. Dept. Agr., Kyushu Imp. Univ.*, *2* (*1928*), *No. 2*, *pp. 75–91*, *figs. 5*).—In the growing point of *V. faba* there was found a daily periodicity in the rate of cell division under constant conditions of illumination, temperature, and moisture. While the curves indicating rate variation did not always correspond to differences in material and condition, there was always a certain definite curve for a given kind of material under the same conditions, a primary and a smaller secondary maximum appearing during the 24-hour period. Elongation proceeded rhythmically. Maximum and minimum tended to occur after periods of regular length rather than at fixed times of day. The resting phase of 8 hours regularly followed the active phase of 16 hours.

"The primary active phase in cell division nearly coincides with the resting phase in the elongation, but the secondary maximum is accompanied by no recognizable resting phase in the elongation. However, the active phase in elongation occurs several hours after the maximum point of primary active phase in cell division."

Winter activity of the roots of perennial weeds, C. F. ROGERS (*Science*, *69* (*1929*), *No. 1785*, *pp. 299, 300*).—A description is given of the winter activity of the roots of the Canada thistle, with special reference to the activity of the buds upon the horizontal regenerative roots. It was found that buds were formed at the Iowa State College in 1924–25 until the middle of November. These developed shoots which formed rosettes of leaves on reaching the surface of the soil. Upon hard freezing the rosettes were killed, but the shoots were unaffected. Later, when the ground had become frozen to a depth of 50 cm. (18.7 in.), latent buds on the larger roots had increased in size, and by the middle of January they had developed into thick, vigorous shoots. In February they had made further development, and by March 3 they had attained a length of from 15 to 30 cm. By April 12, green leaves appeared from the new shoots.

A somewhat similar development of the roots of other perennial weeds is reported.

Studies on the growth of root hairs in solutions.—VII, Further investigations on collards in calcium hydroxide, C. H. FARR (*Bul. Torrey Bot. Club*, *55* (*1928*), *No. 5*, *pp. 223–246*, *figs. 4*).—In the preceding papers of this series (E. S. R., 60, p. 320), giving data on root and root hair development in the case of *Brassica oleracea*, there was included a preliminary study of solutions of $CaCl_2$ of various H-ion and molar concentrations, and also a preliminary study of solutions of $Ca(OH)_2$ and $Ca(NO_3)_2$. The present paper presents further investigations with $Ca(OH)_2$, carried out in 1927 with much the same technic, and includes not only the growth rate of root hairs but also that of the root itself, with data as to the development of roots in these solutions.

The results of this work, as detailed, show that in the very dilute solutions of $Ca(OH)_2$ which support root growth, the Ca ions are entirely consumed in root hair formation, and that the OH ions penetrate and affect the rate of root

elongation. It is found that the length of the hairless tip gives results like those of root elongation; the spacing of the root hairs gives results like those of root hair elongation; and the length of the zone of aquatic root hairs and the length of the interzone give results which are intermediate between those of root hair and root elongation. It is concluded that rates of root and root hair elongation, respectively, are the best criteria of the effect of the solution upon the root development.

The almost entire absence of an interzone in roots in calcium hydroxide solutions is interpreted as being due to the less favorable conditions for root development as compared with root hair development.

The influence of hydrogen ion concentration on the growth of the seedlings of some cultivated plants, T. L. Loo (*Bot. Mag. [Tokyo], 41 (1927), No. 482, pp. 33–41*).—In this preliminary report, dealing particularly with the change of reaction of the culture media, all the experiments were carried out in water culture, employing a modified Knop solution in which $Ca(NO_3)_2$ was replaced by $NaNO_3$ and the ammonium salt of some inorganic acid. The H-ion concentration of these nutrient solutions was found to be under continual change during the growth of the culture plants, the direction of this change depending largely upon the chemical composition of the nutrient solutions, especially the kind of salt used as nitrogen source.

The influence upon several cultivated plants of this change of pH of the nutrient solutions was investigated. Plants show considerable individuality as regards resistance to acidity. Paddy rice differs considerably from corn and wheat in this particular.

The change of pH in the nutrient solution and the consequent adverse effect on the growth of the plant may be avoided either by increasing the buffer power of the solution or by adding calcium ions.

To demonstrate the course of sap ascent in plants, G. J. Peirce (*Science, 69 (1929), No. 1781, pp. 186, 187*).—A method for tracing the course of sap through plants is briefly described. It consists of the use of a suspensoid of finely ground starch, which is said to be readily drawn through the ducts. When the material is to be examined, the branch or plant is heated to form a paste and stained with iodine. By this method it was found that starch was drawn up through 6 internodes of castor-bean in 24 hours and through 6 in. of leafstalk in about half an hour.

Variation of the water content of leaves as related to the wilting of plants, R. Kôketsu (*Jour. Dept. Agr., Kyushu Imp. Univ., 2 (1928), No. 3, pp. 93–116*).—Variation in foliar water content in relation to wilting was studied by determining the leaf water content at the critical wilting stages in *Coleus blumei*, *Glycine soja*, and *Mimosa pudica*. The leaf area method was found, where practicable, to be preferable to the percentage method. The pulverizing method also proved applicable.

While the water contents of the leaves of a plant seemed much alike at a given critical stage of wilting (as beginning or permanent), this value was affected by cultural conditions. The higher the water-holding capacity of culture soils, the larger was the critical water content in leaves of Glycine, Coleus giving opposite results. This relation was supposed by the author to have some connection with the xerophytic nature of the plants.

Leaf water contents at the critical wilting point of different plants proved to differ widely, as did also the ratio of the critical water content to the content at full turgidity. This ratio appeared, moreover, to be a specific quality of a given plant and to indicate the power of resistance of the plant to wilting. This ratio might, therefore, presumably be used as an index for comparison of the degree of xerophytism of plants.

Daily ranges in starch content of leaves [trans. title], W. G. ALEXANDROV (*Ber. Deut. Bot. Gesell.*, *44* (*1926*), *No. 4*, *pp. 217–226*, *pl. 1*, *fig. 1*).—The author, in connection with a review of previous work (E. S. R., 55, p. 324; 57, p. 321), gives herein a brief preliminary account of work done with *Setaria viridis*, *Portulaca oleracea*, *Tribulus terrestris*, *Amaranthus retroflexus*, and *Atriplex laciniatum*.

The physiological significance of lignification [trans. title], O. PORSCH (*Ber. Deut. Bot. Gesell.*, *44* (*1926*), *No. 2*, *pp. 137–142*).—According to the author, the physiological significance of lignification lies in the water relationship which it conditions.

Development of flower and seed of some varieties of sugar cane, E. ARTSCHWAGER, E. W. BRANDES, and R. C. STARRETT (*Jour. Agr. Research* [*U. S.*], *39* (*1929*), *No. 1*, *pp. 1–30*, *pl. 1*, *figs. 17*).—The results are given of a study of the anatomy, ontogeny, and cytology of sugarcane, made as a basis for further research on the taxonomy, physiology, pathology, and genetics of that crop plant.

The effect upon Digitalis purpurea of radiation through solarized ultra-violet-transmitting glass, A. McCREA (*Science*, *69* (*1929*), *No. 1798*, *pp. 628*, *629*).—When digitalis was started under glass that transmitted ultra-violet light and the plants were later transplanted to the field, it was found that digitalis developed a higher potency under the influence of the ultra-violet-transmitting glass. Solarization for one year did not appreciably affect the transmission of the particular portion of such rays as are responsible for such effect in digitalis.

The effect of X-rays on potato tubers for "seed," H. B. SPRAGUE and M. LENZ (*Science*, *69* (*1929*), *No. 1797*, *p. 606*).—Since the report by Johnson on increased tuberization of potatoes caused by X-rays (E. S. R., 60, p. 524), the authors conducted an experiment in which the findings were contrary to those indicated by him. Certified seed of Irish Cobbler and Green Mountain varieties were used.

One half of each tuber was irradiated, and the other half was left untreated as a control. One lot of half tubers was irradiated for 10 minutes and a second lot for 5 minutes. Sprouts were just beginning to develop at the time of exposure, and the tubers were planted in the field on the following day. Each seed piece was cut to a weight of 30 gm., using the bud end, and the pieces were spaced 9 in. in the row.

Plants from the lot of tubers receiving the 10-minute exposure produced only 84.4 per cent as many tubers of all sizes as the untreated controls, and only 89.6 per cent as many tubers weighing over 45 gm. each. The total weight of all tubers was reduced 6 per cent by the treatment. Plants from the lot of tubers irradiated 5 minutes produced 104.7 per cent as many tubers of all sizes as the controls, and 105.1 per cent as many tubers weighing over 45 gm. each. The total weight of all tubers was increased 3 per cent by the treatment.

The 10-minute irradiation caused some injury to the first leaves, but the subsequent leaves of the plants were normal. After the formation of normal leaves the plants were vigorous and remained green several days later than untreated plants at the time of maturity. No striking abnormalities resulting from irradiation were noted in the harvested tubers. Irradiation for 5 minutes produced no apparent modification of plants or tubers.

Summarizing their results, the authors claim that strong dosages which cause definite lesions on leaves may also reduce the number of tubers formed, but such tubers may attain a greater size, so that the yields of marketable stock may not be lowered.

The quickness of killing in heating seeds [trans. title], T. M. POBODKO (*Ber. Deut. Bot. Gesell.*, *44* (*1926*), *No. 2*, *pp. 71–80*, *figs. 4*).—The law involving stimulation intensity-time-constant-response, though simple as regards geotropism and phototropism, is less so as regards other responses. Formulas are given with experimental methods as used in tests with wheat seed subjected to heat, also tabulations of results of heating at different seasons of the year.

Temperature as related to quickness of killing in treating seed [trans. title], T. M. POBODKO (*Ber. Deut. Bot. Gesell.*, *44* (*1926*), *No. 2*, *pp. 80–84*).—This presentation of factual and numerical discussion is based partly upon data reported by other contributors, who are named.

GENETICS

An analysis of the inheritance of quantitative characters and linkage in barley, K. W. NEATBY (*Sci. Agr.*, *9* (*1929*), *No. 11*, *pp. 701–718*, *figs. 7*).—The inheritance of the six barley characters noted earlier (E. S. R., 56, p. 630) was studied further in the F_3 generation of Guy Mayle × Canadian Thorpe barley.

The 2-rowed and the 6-rowed condition in the cross seemed to differ by a single genetic factor. Two factors evidently operate to modify the degree of lateral floret fertility of intermediate types, and also are capable of inducing partial fertility in plants homozygous for the 2-rowed factor. The difference between hulled and hull-less seed was controlled by a single factor pair. Three factors probably were concerned in the inheritance of earliness. When all three factors are in the homozygous recessive condition, the plants develop the winter habit of growth. Density of spike was found to be governed by a single main factor, but the relatively high standard deviation of individual F_3 lines indicated that modifying factors operate also. While the number of factors concerned in the inheritance of height was uncertain, if the average standard deviation of the parental varieties be employed as a criterion of homozygosity, the operation of four factors is indicated. Outer glume length was governed by two factors in inheritance. One factor was incapable of expression in hulled plants and probably carried by Canadian Thorpe, which has short glumes. The other factor was expressed independently of the factors for hulled v. hull-less seed.

All possible relationships between the six character pairs were determined. Three linkage groups were identified, one involving 5 genetic factors, one 3, and the hulled v. hull-less pair constituted a third.

The chromosome numbers of Indian cottons, I. BANERJI (*Ann. Bot.* [*London*], *43* (*1929*), *No. 171*, *pp. 603–607*).—Examination of 28 Indian cottons pertaining to *Gossypium herbaceum*, *G. neglectum*, *G. indicum*, *G. obtusifolium*, *G. cernuum*, and *G. arboreum* and 4 acclimated American cottons (*G. hirsutum*) confirmed the findings of Denham (E. S. R., 52, p. 823). The haploid member was 13 in the Indian cottons and 26 in the American.

The inheritance of certain seed, leaf, and flower characters in *Gossypium hirsutum* and some of their genetic interrelations, W. A. CARVER (*Jour. Amer. Soc. Agron.*, *21* (*1929*), *No. 4*, *pp. 467–480*).—Neither sterility, abnormal characters, nor non-Mendelian segregations were observed at the Florida Experiment Station in the F_1 and F_2 generations of crosses between standard and unimproved varieties of *G. hirsutum*. This is in contrast to the findings of several workers who made studies of the inheritance in crosses between *G. hirsutum* and *G. barbadense*.

The naked seed and fuzzy tip seed characters proved to be simple Mendelian dominants to entire fuzzy seed. Five naked seed characters with lint percentages ranging from about 30 to practically no lint were found to be genetically

identical with regard to the absence of seed fuzz. In F_1 naked seed was dominant to fuzzy tip seed and segregated in F_2 in the ratio of 12 naked : 3 fuzzy tip : 1 fuzzy.

Both green seed fuzz and brown seed fuzz were dominant to white seed fuzz, each cross giving a simple monohybrid segregation in F_2. Green seed proved dominant to brown. When all the possible crosses were made using the characters red leaf, petal spot, naked seed, buff anthers, and okra leaf, no indication of linkage was evident between any of the characters in the F_2 generations.

A red-to-white mutation in maize, R. A. BRINK (*Jour. Heredity, 20 (1929), No. 7, pp. 333, 334, fig. 1*).—A small area of white kernels appeared on a red ear in the offspring between red pericarp and white pericarp lines. The white kernels were also genotypically white. "The more probable explanation is that in the vegetative cell which gave rise to the white section of the ear the gene for red pericarp mutated to white."

Heterosis in Phaseolus vulgaris [trans. title], E. MALINOWSKI (*Rocz. Nauk Rolnicz. i Leśnych (Polish Agr. and Forest. Ann.), 22 (1929), pp. 183–188, figs. 2; Eng. abs., p. 188*).—Studies at the College of Agriculture, Warsaw, showed some vigorous F_2 plants which bred true in subsequent generations. Some vigorous F_4 lines crossed with dwarf varieties transmitted the large size to the F_1 generation.

Haldane on selection, L. J. REED (*Quart. Rev. Biol., 3 (1928), No. 2, pp. 245–253*).—A brief account of the thesis on which Haldane's papers dealing with the mathematical theory of selection are based (E. S. R., 57, p. 820).

On the genetics of human blood groups [trans. title], K. H. BAUER (*Ztschr. Induktive Abstam. u. Vererbungslehre, 50 (1929), No. 1, pp. 3–62, figs.* [2]).—The author has correlated the genetic basis for the determination of the human blood groups with their serological reactions.

The inheritance of human skeletal anomalies, B. L. MILLES (*Anat. Rec., 38 (1928), No. 1, pp. 54, 55*).—A study of family histories indicated that cranial anomalies, depression of the obelion, cleidocranial dystosis, cleft palate, and dental anomalies were evidently hereditary, while malformations of the trunk did not show any marked hereditary tendency. Polydactyl, brachydactyl, and fragilitis osseum are evidently due to Mendelian dominant factors. The mode of inheritance of cranial anomalies was not clear.

Studies on the relation of gonadic structure to plumage characterisation in the domestic fowl.—III, The laying hen with cock's plumage, F. A. E. CREW (*Roy. Soc. [London], Proc., Ser. B, 101 (1927), No. B 712, pp. 514–518, pl. 1*).—In continuing this series (E. S. R., 57, p. 221), the author reports that a cock-feathered laying hen is a normal female in every respect except that her plumage is similar to that of a castrated bird following the molt. This is considered due to a transient disfunctioning of the ovary, with possible association of lack of functioning of the thyroid at that time.

Seasonal modifications in testes of vertebrates, R. M. OSLUND (*Quart. Rev. Biol., 3 (1928), No. 2, pp. 254–270, figs. 8*).—From a discussion of the seasonal variations and associations between the volume of the interstitial cells and germinal tissue in vertebrates and invertebrates the author considers that there is apparently no relation between the changes in the interstitial tissue and sexual activity, though it is pointed out that methods of determining the amount of interstitial cells are not very accurate and the time required for the action of the testicular hormone has not been generally determined for the different classes of animals.

The possibility of cytoplasmic or nuclear changes paralleling periods of sex activity is discussed, but germ cell development seems to be the only

parallelism between any testicular element and sexual activity which is constant. The presence of active germinal epithelium seems sufficient to insure hormonal activity.

The effect of human placental extract on the mammary glands of male guinea-pigs, H. O. HATERIUS (*Anat. Rec., 38* (*1928*), *No. 1, pp. 14, 15*).—Injection of 0.5-cc. doses of human placental extract having a strength of from 20 to 25 rat units into castrated adult male guinea pigs resulted in the swelling of the mammary glands. The nipples displayed a marked hypertrophy, evidenced particularly in the epithelium and by a thickening of the stratum corneum. There was some evidence of active milk secretion. The glandular structures also increased proportionately.

Ovarian-hormone effects in immature monkeys, E. ALLEN (*Anat. Rec., 38* (*1928*), *No. 1, p. 2*).—Injections of doses of the ovarian hormone until the total dose exceeded 1,000 rat units into normal and ovariectomized immature monkeys caused reddening and swelling of the sexual skin and modifications of the cell content of the vaginal smear to the interval type of the mature animal, with considerable enlargement of both the cervix and body of the uterus and thickening of the vaginal walls, as well as other associated conditions. The ovaries of injected normal animals were smaller and contained fewer primordial and medium sized follicles than controls. Some harmful effects were indicated through the presence of atresic follicles.

Gross changes in the uteri of ovariectomized adult monkeys after discontinuance of injections of ovarian and placental hormone, E. ALLEN (*Anat. Rec., 38* (*1928*), *No. 1, p. 38*).—Study of the uteri of ovariectomized adult monkeys which had been treated with injections of ovarian and placental hormone over a considerable period showed that when killed from the first to the third day after the injections were stopped the mucous membranes were pearly white. On the fifth day after injection the uteri were in an early menstrual stage, and the surface of the mucosa was hemorrhagic.

Variations in the vascularity of the uterus of the guinea-pig during the oestrous cycle, J. E. MARKEE (*Anat. Rec., 38* (*1928*), *No. 1, p. 22*).—Variations in the blood supply of the uterus of guinea pigs were observed which were associated with the time of day and the stage of the oestrous cycle, as well as with conditions to which the animal was subjected. Under ether anesthesia during dioestrum the uterus changed in color from 60 per cent hemoglobin, as indicated on a Talquist hemoglobinometer and recorded on a kymograph, to nearly white and back about every two minutes. Similar changes were observed on other animals at different stages in the cycle.

The mechanism of ovulation and implantation in the domestic cat, E. J. MANWELL and P. G. WICKENS (*Anat. Rec., 38* (*1928*), *No. 1, p. 54*).—Vaginal smears taken over a period of months showed wide variations, but, coincident with marked external signs of oestrum, masses of cornified cells with the absence of leucocytes were invariably found. No corpora lutea were observed in unmated cats sacrificed at various times during oestrum, though unsegmented ova, blastocysts, and small embryos were recovered from mated animals. Implantation had occurred at 285 hours after mating.

Experiments on fertilization and parthenogenesis in the mammalian ovary and on the production of the corpus luteum, O. F. KAMPMEIER (*Anat. Rec., 38* (*1928*), *No. 1, p. 17*).—In efforts to fertilize the ova in the ovaries of bitches through injection of spermatozoa into the Graafian follicles, typical cleavage stages of from 2 to 8 or more cells were observed. In 3 of the 10 ovaries studied such cleavage stages were numerous, as many as 12 occurring in one ovary. It is suggested that perhaps the cleavage stages have had a parthenogenetic origin, as such development probably occurs normally in few

of the many ova doomed to extinction. The formation of corpus luteum was observed following the puncture of large follicles, with the resulting hemorrhage.

Inhibition of oestrus and the experimental production of deciduomata in the rat by extracts of corpora lutea of pregnancy, A. PEREYRA (*Anat. Rec., 38 (1928), No. 1, p. 57*).—Extracts of corpora lutea of sows were found to inhibit ovulation for periods of from 16 to 29 days when daily injections of 0.5 cc. were administered. Under such conditions deciduomata were produced when silk threads were inserted through the uterine musculature and endometrium.

Experiments on the function of the corpus luteum, G. W. CORNER (*Anat. Rec., 38 (1928), No. 1, pp. 8, 9*).—Autopsy of female rabbits from 4 to 7 days after the ovaries were removed, incised, or the corpora lutea removed at 18 hours after mating indicated that no postovulational change occurred and the embryos had reached the uterus but degenerated when either the ovaries or the corpora lutea were removed, but postovulational proliferation always occurred and the embryos were mainly normal when the ovaries were incised. It therefore appears that the corpus luteum is necessary for the production of endometrial proliferation and nutrition of the embryos, even before implantation.

Variations in mouse embryos of eight days' gestation, E. ALLEN and E. C. MACDOWELL (*Anat. Rec., 38 (1928), No. 1, p. 2*).—Study of mouse embryos at the eighth day of gestation, which corresponds with the first day's growth of the embryo proper, indicated that at the end of this day the number of somites vary from 0 to 7 and the weight from 0.02 to 0.2 mg. The embryos in the same litter may all be in the presomite stage, or some may have no somites and others from 2 to 5. The variation was not associated with litter size.

The effect of certain endocrine substances upon the prenatal development of the chick embryo, E. B. HANAN (*Anat. Rec., 38 (1928), No. 1, p. 14*).—Injections of up to 26 units of insulin into the air sac of the incubating hen's egg appeared to have no effect on the viability or growth curve of the chick, though marked hypoglycemia was produced.

Similar injections of thyroxin were found to be remarkably toxic. Only 1/40,000 mg. was tolerated. Such injections resulted in increased carbon dioxide production for about 3 days, followed by a marked depression below normal over a period of about 8 days. The tolerance to thyroxin was considerably increased when it was absorbed into the albumin at an early stage of incubation.

Differentiation of trophoblast cells in the pig ovum, G. L. STREETER and C. H. HEUSER (*Anat. Rec., 38 (1928), No. 1, p. 63*).—On the fifth day after insemination when the pig ovum is composed of about 16 cells the trophoblast cells become histologically differentiated. They lose their primitive form as round and become flattened into a continuous single-layered sheet against the zona, and the fluid of the segmentation cavity begins to accumulate. These cells soon constitute a membrane inclosing the ovum. The last cells to separate out into the trophoblast give rise to the germ disk and its underlying entoderm.

FIELD CROPS

The grasslands of New Zealand, E. B. LEVY (*New Zeal. Jour. Agr., 34 (1927), Nos. 2, pp. 73–83; 3, pp. 145–164, figs. 9; 6, pp. 361–375*).—These pages report the progress of reseeding experiments during several years on run down hill land, including tests of seed mixtures, burning and seeding trials, and studies of methods to win back second growth country.

Alfalfa in western Oregon, H. A. Schoth and G. R. Hyslop (*Oregon Sta. Bul. 246 (1929), pp. 38, figs. 13*).—The distribution, adaptation, soils, varieties, and cultural and harvesting requirements for alfalfa in the western part of Oregon are discussed from experiments in cooperation with the U. S. Department of Agriculture and field observations. Practical information is given on the management of the crop for hay, seed, pasture, silage, soiling, cover crops, and green manure; its culture under irrigation and in rotations; and on control of weeds, rodents, diseases, and insect pests.

Experiments during six years showed the earlier applications of land plaster, especially March 10, to result in the largest yield increase. There was a progressive yield increase accompanying the increase in rates from 50 to 125 lbs. of land plaster per acre. With flowers of sulfur, a 75-lb. rate gave the largest yield increase. While the use of superphosphate and potassium sulfate gave increased yields, land plaster or sulfur appeared to be preferable.

Corn varieties in Texas: Their regional and seasonal adaptation, P. C. Mangelsdorf (*Texas Sta. Bul. 397 (1929), pp. 74, figs. 15*).—Experiments on the effects of time of planting of different corn varieties carried on in 11 localities in Texas from 1918 to 1927 disclosed that early-planted corn usually is more productive than medium-planted corn and practically always outyields late-planted corn. While the loss in yield due to late planting varies with the season, the variety, and the locality, in general the optimum time of planting nearly coincides with the average date of last frost. Time of planting and date of silking appeared to be related closely, such that the period between planting and silking is shortened with delay in planting.

Some varieties, such as Surcropper and Ferguson Yellow Dent, exhibit a wide range of adaptation to regional conditions and are almost equally productive in all parts of the State, whereas Strawberry, Hastings Prolific, Chisholm, Brazos White, Bloody Butcher, Horton, and Oklahoma White Wonder show a medium range of regional adaptation and are better than average in several localities and poorer than average in others. Varieties with a narrow range of adaptation, such as Thomas, Tuxpan, and Blount Prolific, yield extremely well under one set of regional conditions but are very inferior under another environment. Mexican June and Surcropper are affected only slightly in yield by time of planting, while Ferguson Yellow Dent, Chisholm, Strawberry, Oklahoma White Wonder, and Brazos White are reduced considerably in yield as the result of late planting.

Recommendations are made for time of planting and choice of varieties for different regions of Texas determined on soil type, rainfall, and temperature. It is observed that maximum yields of corn can be obtained only by planting at the optimum time varieties well adapted to the region.

Silage corn varieties for Utah, G. Stewart and A. L. Wilson (*Utah Sta. Bul. 211 (1929), pp. 16, figs. 3*).—Early and late plantings of several corn varieties at the Davis County Experimental Farm near Farmington from 1921 to 1926 showed that Boone County White, planted late in April or early in May, can be grown profitably for silage on the lighter soils. The prolonged ripening season on heavier soils makes it inadvisable to grow a variety later than Improved Leaming.

The development of secondary seminal roots in corn seedlings, H. J. Siemens (*Sci. Agr., 9 (1929), No. 11, pp. 747–759, figs. 5*).—Experiments at the University of Minnesota on corn varieties obtained in the Northwestern States and nearby Canada demonstrated that corn types differ in seminal root habit. The flint corns and Michigan pop corn usually produced no secondary seminal

roots. Of the sweet corn varieties 60 per cent of the kernels and of the dent corn varieties 90 per cent produced secondary seminal roots. The kernels of the sweet corns tested were found to produce no secondary seminal roots more often than any other number, whereas the kernels of the dent varieties produced three secondary seminal roots most often. One selfed line of Northwestern dent produced practically no secondary seminal roots. Exposing the kernels to 7° C. under otherwise germinating conditions for 60 days and then transferring them to 28° for 5 days induced about 40 per cent of the flint seedlings to develop secondary seminal roots. Observations on sand cultures showed that the secondary seminal roots form an extensive root system for the corn seedling.

Cotton fertilizers and cultural methods, R. P. Bledsoe (*Georgia Sta. Bul. 152 (1929), pp. 37, figs. 8*).—Fertilizer and cultural experiments were carried on with cotton on Cecil sandy clay loam from 1921 to 1928, inclusive, under seasonal conditions described as the worst in the history of the State. Boll weevil also was an adverse factor.

As sole nitrogen sources, based on current prices, readily available inorganic carriers, such as calcium nitrate, sodium nitrate, and ammonium sulfate, gave highest returns. Based on sodium nitrate as 100, the relative value per pound of ammonia was calcium nitrate 111, sodium nitrate and ammonium sulfate 97, and ammonium sulfate 85. While ammonium sulfate is a slightly cheaper source of nitrogen than sodium nitrate, the combination of equivalent quantities of the two salts was cheaper than either alone. Equivalent quantities of nitrogen from sodium nitrate and cottonseed meal in mixture rated 87, higher than the average of the materials alone, but the mixture was not economical.

Compared to cost, the fertilizer values of the nitrogen from cottonseed meal, velvetbean meal, cottonseed, peanut meal, tankage, and cyanamide used as sole sources of nitrogen for cotton were found to be very low. Tests over one to three years showed Calurea, Leunasalpeter, and urea to be very promising sources of nitrogen for cotton when price was considered.

When sodium nitrate was applied at rates of 33, 100, 167, and 233 lbs. per acre the yield of seed cotton rose with each increase up to 233 lbs., although the most profitable rate was somewhere between 167 and 233 lbs. Comparing different ratios of organic (cottonseed meal) and inorganic (sodium nitrate) nitrogen, the highest yield came from the 20 organic : 80 inorganic mixture. Ten per cent organic nitrogen, or just enough to keep the mixture in good mechanical condition, appeared most economical for the soils. Cotton top-dressed with sodium nitrate at squaring time produced much poorer than when top-dressed at chopping or when all of the sodium nitrate was applied at planting. Applying all of the sodium nitrate or ammonium sulfate at planting, or at chopping, or half at planting and half at chopping seemed to make little difference on clay soils.

Mixture of limestone with ammonium sulfate resulted in a very large increase in seed cotton over ammonium sulfate alone. Limestone with a mixture containing nitrogen equally from sodium nitrate and ammonium sulfate gave a large increase over a like mixture without limestone. Limestone and sodium nitrate did not result in an increase over sodium nitrate alone, except where sodium nitrate was used in very large quantities. Although sodium nitrate generally produced more cotton than ammonium sulfate per pound of nitrogen used, an exception to this was where limestone was used with ammonium sulfate.

Superphosphate, as indicated by yields of seed cotton, gave better results than rock phosphates. The several kinds of rock phosphates did not differ much

between themselves, the differences observed seeming due to the varying degree of fineness and the percentages of phosphoric acid contained.

Addition of limestone to a mixed fertilizer containing superphosphate, blood, and potassium chloride produced an increase in yield, while addition of ferrous sulfate produced a decrease. These results were not held conclusive.

On the test soil from 24 to 36 lbs. of potash under cotton gave best results. However, good returns came from potash applied at chopping or top-dressing.

None of a number of concentrated fertilizer mixtures produced as good results as were obtained from ordinary commercial materials, and the efficiency of concentrated fertilizer was not enhanced by the addition of a filler. Home-mixed fertilizer was as good as or slightly more effective than commercially mixed fertilizer.

Cultivated cotton made slightly less seed cotton per acre than uncultivated cotton from which the weeds were hoed, suggesting that cultivation is necessary to kill weeds but should be as shallow as possible. Cotton plants spaced 8 in. apart in the row made higher acre yields of seed cotton than closer or wider spaced plants. Delayed thinning decreased yields.

A note on the early history of cotton, A. N. GULATI and A. J. TURNER (*Jour. Textile Inst., 20 (1929), No. 1, pp. T1–T9, pl. 1*).—Cotton fabric and cord unearthed in recent excavations at Mohenjo-daro in the Indus Valley in Sind about 200 miles beyond Karachi are assigned to about 3000 B. C. Examination indicated tentatively that the fiber of one sample resembled *Gossypium arboreum* rather than *G. herbaceum.*

The British Cotton Growing Association: Twenty-fourth annual report for the twelve months ending December 31, 1928 (*Brit. Cotton Growing Assoc. [Pub.] 108 (1929), pp. 64, pls. 9*).—The activities of the association in 1928 in promoting cotton production in British colonies and possessions are reviewed as in earlier years (E. S. R., 60, p. 534).

Field plot technique with potatoes, with special reference to the Latin square, L. E. KIRK (*Sci. Agr., 9 (1929), No. 11, pp. 719–729, fig. 1*).—Early Ohio potatoes were planted at the University of Saskatchewan in 132-ft. rows which were harvested in 22-ft. units, and the yields combined to give results for plats 44, 66, and 132 ft. long. The mean yields of 1, 2, and 4 systematically distributed plats for each of the several sizes were obtained. Yields from four adjacent rows 22 ft. long arranged at random in a Latin square were considered and the variability compared with the yield of row plats of different lengths with replicates systematically distributed.

Replication was found to be about twice as effective as increasing the length of row. In comparison with a single plat test, four systematically distributed plats reduced the variability about 50 per cent, whereas increasing the length of row from 44 to 132 ft. reduced the variability on the average about 25 per cent. When compared with 132-ft. row plats and four replicates of each, the Latin square method of planting gave a probable error which was 27 per cent lower, the same area of land being required in each case.

A suggested method adapted to machine calculation has been found to facilitate the statistical analysis of the yields of plats arranged in a Latin square.

Potash fertilization and culinary value of potatoes (*Rhode Island Sta. Rpt. [1928], p. 51*).—Greater mealiness was produced in potatoes by high potassium fertilization, and when equal quantities of potassium were used, the potatoes grown with the chloride were more mealy than those with the sulfate.

Comparative influence of different storage temperatures on weight losses and vitality of seed potatoes, W. STUART, P. M. LOMBARD, and W. M. PEACOCK (*U. S. Dept. Agr., Tech. Bul. 117 (1929), pp. 18, figs. 7*).—Potatoes

stored in barrels at Rosslyn, Va., from November 26, 1920, to April 20, 1922, i. e., through two normal storage periods, at 32° F. sustained heavy losses through rotting, 88.5 per cent with Gold Coin and 72.4 per cent with Irish Cobbler, whereas at 40° the respective percentages were 3.2 and 4.1 per cent. The Gold Coin stored at 40° showed slight germination in some tubers, while all of the Irish Cobblers showed an advanced stage of sprout development.

With varieties stored at about 40° in 1924–25 in special fiber boxes at Presque Isle, Me., Canton, Pa., and Rosslyn, Va., the average loss of the Irish Cobbler was the lowest, with Triumph, Green Mountain, and Russet Rural following in order. The percentage of loss at Presque Isle was less than half that at Canton and at Rosslyn, the percentages being 4.01, 8.07, and 8.49, respectively, but seed stored at Canton gave consistently higher yields than that stored in the other two storage houses.

The same varieties were stored at Canton in 1925–26 in fiber containers above ground, in an insulated room, and in a bank cellar as soon as possible after harvest. Weighings between October 1 to 4 and May 3 indicated that some varieties lose more weight in storage than others, and the data also suggest that the shrinkage due to respiration and transpiration is directly correlated with the ripeness of the tubers when harvested. Russet Rural tubers, being the least mature, showed the greatest loss in weight. The tubers stored in the above-ground storage house showed consistently lower weight loss. Up to March 4, at least, there was only a slight difference in the percentage of loss from tubers stored in the other storage rooms.

Comparative studies of the relative influence of different storage temperatures as conducted at Rosslyn, at the Virginia Truck Experiment Station, and at Presque Isle did not reveal any marked differences in yields from the Irish Cobbler variety. Lower yields were obtained at Rosslyn from Green Mountain seed stored at 32° than at 36 or 40°, while at Presque Isle there was no appreciable difference. A fairly good increase in yield was obtained at Rosslyn in 1921 from seed removed from storage and held for 12 days at about 70° as compared with that from similar stock planted direct from storage.

Factors influencing the growth and sugar contents of cane, K. Krishnamurthi Rao (*Facts About Sugar, 24 (1929), No. 29, pp. 690, 691*).—Consideration of studies on the influence of temperature and moisture factors on the growth and sugar content in India and elsewhere led the author to infer that, with other conditions satisfactory, growth of sugarcane starts at a mean temperature of about 68° F., and increases progressively with the gradual rise of temperature, reaching its maximum at a mean of about 88°. Growth is arrested when the mean temperature is about 65°, and buds are injured at a temperature of about 52°. Countries having a long, humid, and warm season during the growth period with an average mean temperature of 78° and a fairly dry, cold season with an average mean temperature of 59° appear best suited for cane cultivation.

Sugar cane test fields and fertilizer demonstrations, C. B. Gouaux (*Louisiana Stas. Bul. 203 (1929), pp. 23*).—Varietal comparisons with sugarcane made in the same localities as the previous year (E. S. R., 59, p. 527), showed P. O. J. 213 to lead in sugar yield per acre. This cane is held to be the most satisfactory cane for all parts of the Louisiana sugar belt and is said to be excellent both as plant cane and ratoon. The variety 36–M ranked second in the plant cane series.

Application of 200 or 300 lbs. of sodium nitrate together with 200 lbs. of superphosphate on first-year stubble of P. O. J. canes usually resulted profitably, giving an average increase of 5.41 tons of cane, or a net profit of $8.64 per

acre. The results of plant cane demonstrations on alluvial sandy clay loam soil confirmed the station recommendations, showing that it is unprofitable to fertilize plant cane where a good crop of soybeans has been turned under. On Red River sandy clay loam soil there was a profit with 200 lbs. of sodium nitrate. Striking increases were also obtained on Crowley silt loam in Vermilion Parish.

Preserving sugar cane tassels for breeding purposes, B. A. Bourne (*Facts About Sugar, 24 (1929), No. 25, pp. 592–594, 596, figs. 2*).—An approximate dilution of 1 to 4,444 parts of sulfurous acid with distilled water gave the best results for preserving sugarcane tassels with that chemical in investigations at the U. S. Sugar Plant Field Station, Canal Point, Fla. Distilled water was found much superior to other water for the purpose. Differences were observed in the keeping quality of cane varieties in sulfurous acid solution. Both formic and phosphorous acids gave promising results with varieties having one-half or one-quarter Chunnee blood, although tassels of "noble" parentage or even one-eighth noble (e. g., P. O. J. 2725) could not be preserved as long as in the case of sulphurous acid solution. Very satisfactory results have been obtained with formic acid as a preservative for male tassels during cross-pollination.

A new type of tassel rack, described and illustrated, protects solutions from dilution, light, and foreign matter.

Timothy for hay seeded in wheat at different times and rates, M. W. Evans (*Ohio Sta. Bimo. Bul. 139 (1929), pp. 115–121, figs. 2*).—Seeding tests with timothy in cooperation with the U. S. Department of Agriculture at the Timothy Breeding Station at North Ridgeville demonstrated that when timothy is seeded at the acre rate of 5 or 10 lbs. or more with winter wheat, and clover is sown in the spring, the yield of hay and the proportion of clover it contains are lower than if the timothy seed is spring sown with a satisfactory stand. Increase in the rate of the fall-sown timothy was followed by a gradual increase in the timothy percentage in the first crop of mixed hay, a corresponding decrease in the percentage of clover, and a lower yield. This yield decrease as the seeding rate increased also occurred in the second season when the meadow produced clear timothy hay. It seemed advisable to sow not more than 2 or 3 lbs. of timothy with the fall grain and then to add more timothy seed if needed when the clover is spring sown.

Soil reaction and liming as factors in tobacco production in Connecticut, M. F. Morgan, P. J. Anderson, and H. Dorsey (*Connecticut State Sta. Bul. 306 (1929), pp. 769–806, figs. 11*).—Extensive investigations were concerned wih the soil reaction in relation to tobacco production and the causes, effects, and control of soil acidity, especially in regard to the use of lime. Review of other investigations in tobacco sections of the United States and Canada showed that lime rarely has produced material increases in the tobacco crop in field experiments, and that in some cases injury follows the use of lime. This is held due to the greater prevalence of black root rot on limed soils.

A study of methods for the determination of soil acidity showed that a close correlation exists between pH values as determined by both colorimetric and electrometric (quinhydrone electrode) methods and the Jones lime requirement results, when the modifying effect of texture and organic content of the soil are properly evaluated. Correlation factors for various textural classes of different organic contents have been computed. The results of soil reaction studies on tobacco soils in New England have been noted earlier (E. S. R., 61, p. 332).

Increased growth of tobacco was made on very acid soils, i. e., below 4.8 pH, when lime was added to a complete fertilizer treatment in greenhouse

experiments. In the field, on a very acid soil which produced poor tobacco even when liberally fertilized, tobacco was improved considerably by lime and superphosphate. On extremely acid soils it seems that the injurious effects may be due to toxic manganese, aluminum, or both.

The effects of different fertilizers on the soil reaction and of lime on the composition of tobacco have been reported on (E. S. R., 61, p. 134). Liming at various rates and certain fertilizer precautions are indicated for soils testing below the reaction 5 to 5.6 pH in acidity.

Tests of tobacco fertilizers comparing nitrogen, phosphorus, and potassium from different fertilizer sources, T. B. Hutcheson and T. L. Copley (*Virginia Sta. Tech. Bul. 35 (1929), pp. 10*).—Fertilizer experiments with bright flue-cured tobacco were conducted on Cecil sandy loam by the Pittsylvania County Substation near Chatham, Va., during the years 1920–1922 and 1924–1927, inclusive.

The inorganic sources of nitrogen proved more efficient than the organic sources when used alone. Sodium nitrate and ammonium sulfate in combination were more satisfactory than either alone. Animal tankage, cottonseed meal, and fish scrap were superior to other organic materials. Nitrogen from high-grade inorganic sources three parts and organic sources one part was more efficient in combination than where more organic material was used. Superphosphate was found to be a satisfactory phosphorus carrier for tobacco fertilizer.

Potassium chloride and other potassium salts carrying chlorine, when not used in excess, have improved the yield and selling price per acre of bright tobacco. The chlorine in the fertilizer seemed to increase the resistance of the plants to drought spot, although excessive chlorine reduced the burning quality of the leaf. Indications are that chlorine in small quantities increased the efficiency of the fertilizer but that it should not be used in excess of 2 per cent.

It is concluded that for a satisfactory fertilizer for bright tobacco three-fourths of the nitrogen may come from high-grade inorganic materials and one-fourth from high-grade organics, the phosphorus from superphosphate, and the potassium 2 per cent from potassium chloride and the remainder from high-grade potassium salts containing no chlorine.

Distribution of the classes and varieties of wheat in the United States, J. A. Clark, J. H. Martin, K. S. Quisenberry, J. R. Hooker, C. E. Leighty, and C. N. Dubois (*U. S. Dept. Agr. Bul. 1498 (1929), pp. 68, figs. 92*).—The distribution and acreage of the classes and varieties of wheat are indicated from the results of extensive surveys made in 1919 and in 1924. Varietal maps show the distribution of the more important varieties. The estimated acreages, the percentage of the total wheat acreage occupied by each variety in 1919 and 1924, and the increase or decrease in the percentage of the acreage during the 5-year period are tabulated by States and for the United States as a whole.

The hard red spring class of wheat is grown in all except the South Atlantic division but principally in the North Central States. Durum wheat is grown in the same general divisions and in most of the States growing hard red spring wheat. Durum is not a leading class of wheat in any State, although it is grown most widely in North Dakota. While hard red winter wheat is grown in all divisions, its production is centered in the Central States. Soft red winter wheat also is grown in all divisions. White wheat is grown in all divisions, yet more extensively in the far Western States. Turkey, Marquis, and Kanred, in order, are the varieties most widely grown.

Admixtures and off-types in Marquis wheat, J. B. Harrington (*Sci. Agr., 9 (1929), No. 11, pp. 730–737, fig. 1*).—Cultures at the University of Saskatche-

wan from 387 samples of Marquis wheat obtained in 1925-26 from country elevators in the Province showed that only 9 per cent of the samples were without from 1 to 4 general types of impurity, and the impurity ranged from 0 to over 50 per cent. The impurities consisted of identified varieties, most often Ladoga, Preston, Stanley, Huron, and Red Fife, and unidentified types apparently mostly segregates from natural crosses between Marquis and the varieties occurring as admixtures. Progeny tests of 113 samples of Marquis obtained by the Saskatchewan Department of Agriculture from 22 districts in a seed drill survey revealed the same kinds of impurities as in the elevator samples and generally in similar proportions. A far larger percentage of the seed drill samples was pure than of the elevator samples, indicating that purer wheat is sown than is marketed at elevators. Mechanical mixing and natural crossing appeared to be responsible for practically all of the impurities in Marquis.

Milling and baking qualities of pure lines of Arizona-grown wheat, W. E. BRYAN and E. H. PRESSLEY (*Arizona Sta. Tech. Bul. 27 (1929), pp. 55–100, figs. 4*).—Technological tests on pure lines from different commercial varieties of wheat grown in Arizona for a number of years demonstrated that such pure lines of bread wheat maintain a rather constant level in milling and baking quality when grown under irrigation in southern Arizona. While certain of the strains of this group were more susceptible to seasonal variations and showed an inherently lower level of quality than others, no evidence of permanent change in the various quality factors appeared, with the possible exception of gluten content in some of the less well adapted strains. The red wheats of the Middle West did not seem so well adapted to the production of bread flours under irrigation in the Southwest as are the soft, white wheats.

Comparative studies of several pure lines of hard Baart and a high-yielding pure line of soft Baart (34–16) also with high baking quality showed that the hard, glassy kernel texture on which the hard Baart strains were chosen originally from commercial soft Baart was maintained without tending toward permanent softening when grown continuously for 7 years under irrigation. The hard, glassy texture of these strains appeared to be definitely heritable.

The soft strain 34-16 was not far below the highest average hard strain in loaf volume during 3 years and averaged 11.1 per cent in dry gluten as compared with a range of from 10.9 to 13.4 per cent in the hard strains. Evidently hard, glassy texture in white wheat is not a reliable criterion for isolating strains high in gluten content. The most striking and consistent difference between the hard and soft strains was shown in the higher water absorption and bread yields of the flour of the hard strains. Correlations determined in the hard strains were between dry gluten and loaf volume $r=-0.1809\pm0.5505$, dry gluten and percentage of absorption $+0.6221\pm0.0377$, and percentage of absorption and volume of loaf -0.2828 ± 0.0566.

The average yields of 59 hard strains, as determined from 25 to 30 plats of each strain, varied from 8.71 ± 0.81 bu. per acre less to 2.6 ± 0.81 bu. more than the soft strain over 3 years' tests.

The investigations are held to show that it is possible to grow high-yielding, hard, white wheat varieties under irrigation in southern Arizona and to indicate that the greatest benefit to be derived from the use of such wheats for bread making is their higher bread yields due to high absorption.

The Hungarian Seed Control Station in Budapest, 1922–1927 [trans. title], G. LENGYEL (*Kisérlet. Közlem., 32 (1929), No. 1, pp. 1–68; Ger. abs., p. 68*).—Activities of the station (E. S. R., 53, p. 340) during the period 1922–1927 are reported in Magyar and German. Tables show the total number of samples tested each year, results of tests of sugar beet and fodder beet seed,

determinations of purity and germination of agricultural and miscellaneous seed for the years indicated, and the average results of seed tests over the period 1896–1927.

An easier way to kill quack grass and Canada thistles, C. J. Willard (*Ohio Sta. Bimo. Bul. 139 (1929), pp. 121–125*).—The characteristics of sodium chlorate and methods of using it in weed control are outlined, with precautions to be observed. Preliminary tests at Ohio State University and several test farms are reviewed.

For quack grass from 150 to 300 gal. per acre or 1 to 2 gal. per square rod of solution of 1 lb. of sodium chlorate per gallon of water may be applied most practically after an early hay crop is removed. While one thorough spray has killed the weed, at least three applications may be needed for eradication.

The best period for spraying Canada thistle the first time seemed to be from June 15 to July 15. A solution of 0.5 lb. per gallon was quite effective on thistle.

A heavy, thorough spraying at full strength killed poison ivy repeatedly in one application, and two, or at most three, sprayings have always succeeded when the first one did not. Other weeds that have been treated successfully are bindweed, ironweed, artichokes, horseradish, burdock, spearmint, steelweed or frostflower, goldenrod, and whitetop.

HORTICULTURE

[Horticultural investigations at the Rhode Island Station] (*Rhode Island Sta. Rpt. [1928], pp. 45, 51, 52, 53*).—Brief reports are given on various fertilizer and varietal tests. An 8–6–6 (N–P–K) fertilizer applied at the rate of 1,500 lbs. per acre gave better results with cabbage than did those containing less nitrogen. Celery and beets responded adversely to a reduction of nitrogen and potash below that contained in 1,500 and 1,200 lbs., respectively, of an 8–8–6. Where green manure was grown both cabbage and celery showed less reductions from decrease in any of the three fertilizer elements. Supplementing commercial fertilizer with stable manure or using stable manure alone was more effective than commercial fertilizer alone for tomatoes growing in the greenhouse. Gladiolus corms dug in March in Florida and planted November 1 in a station greenhouse showed first bloom on January 18. Notes are given on the winter injury to grapes and bush fruits. The Latham raspberry proved unusually resistant.

Studies on the reaction of greenhouse soils, W. W. Wiggin (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 45–48*).—Notes are presented on the response of various flowering plants to maintained soil reactions obtained by applying lime or aluminum sulfate. Considerable difficulty was met in maintaining uniform reactions in the various plats. The plants themselves in some cases tended to modify the H-ion concentration. Snapdragons and chrysanthemums increased acidity, while carnations and calendulas decreased acidity. Wide variability was noted in the soil reaction of all species except the hydrangea and cyclamen. Cow manure, complete fertilizer, lime, vigoro, slag, and sheep manure tended to promote alkalinity, and even peat moss (pH 3.8) when applied at the rate of 10 tons per acre caused little if any change in the soil reaction. Sheep manure gave the quickest response. The soil reaction preferences of the various flowers tested are given.

The vegetables of New York, Vol. I, pt. 1: Peas, U. P. Hedrick, F. H. Hall, L. R. Hawthorn, and A. Berger (*New York State Sta., 1928, pp. VI+132, pls. 24*).—Conforming in general object and scope to the seven volumes on tree and small fruits (E. S. R., 55, p. 39), this monograph, illustrated in color, dis-

cusses the history of the garden pea and the botanical status of the common pea and related species, and presents technical descriptions of the species and varieties, with the latter grouped according to apparent relationships. Cultural information is purposely excluded to save space.

Factors influencing yield and quality of peas: Biophysical and biochemical studies, V. R. Boswell (*Maryland Sta. Bul. 306 (1929), pp. 341–382*).—Records taken on samples of pea plants from contrasting areas in pea fields near Centerville showed that nodule formation is distinctly greater in plants growing in "good spots." Using the coefficient of correlation as an index, it is shown that in general the better the nodule development the higher the correlations between plant weight and pod number, pea number, and pea weight. A wide variation was observed in the amount of nodule formation in different fields. Under the conditions studied soil acidity was not a limiting factor in nodule formation or plant growth. Organic matter in the soil was a potent factor in increasing yields. No significant differences were found in the nitrates present in good and poor soils, but a delay in analyses rendered results doubtful.

Fertilizer studies gave somewhat conflicting results, but indicated the value of a high nitrogen content. Mixtures ranging from 5–8–3 to 7–6–5 (N–P–K) appeared promising. Muriate of potash alone or combined with nitrogen and phosphorus gave no consistent results.

At College Park it was found that temperature is the most potent climatic factor affecting the development and yield of the pea plant. The higher the temperature the shorter the time required for the pea plant to reach a given stage of development, and the higher the mean temperature during growth the lower the weight of plant and the weight and number of pods and peas per plant.

Of chemical changes occurring during growth and maturation of pea seeds, the most notable were (1) a rapid decrease in sucrose, total soluble nitrogen, amides, amino acids, basic nitrogenous substances, and materials which form humin compounds upon hydrolysis, (2) an increase in starch, acid hydrolyzable substances, and insoluble nitrogen, and (3) a less rapid decrease in total nitrogen. Low sugar and high starch contents denoted low quality whether a varietal characteristic or the result of overmaturity.

Concerning the effect of temperature, as determined by the time of planting, upon chemical composition and quality, it was noted that late planting did not cause an inherently higher starch and lower sugar content, provided the crops were harvested at the correct stage. Starch-sugar ratios at harvest were closely correlated with temperature summations from blossoming to harvest, but not with mean temperature. Late planting is not advisable, chiefly on account of reducing yields.

As determined by R. C. Yoder, grading pea seeds to various sizes before planting had no significant effects on time of blossoming, of ripening, or upon yields. In a strain test with the Alaska variety the lots of seed generally considered reliable by canners were found quite uniformly good.

Temperature influence upon chemical composition and quality of peas (Pisum sativum, L.), V. R. Boswell (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 21–26*).—A further contribution from the Maryland Experiment Station upon the temperature relations in garden-pea production (E. S. R., 58, p. 231).

Studies of the composition of peas harvested from Alaska plants the seeds of which were sown in succession showed no inherently lower quality in the product of the late sowings, provided the crop was harvested at the proper stage of maturity. The author believes that the low quality product frequently obtained from late plantings is probably the result of a rapid maturity under

high temperature conditions. The changes may be so rapid as to cause the latter part of the crop to pass proper condition before harvesting is completed. The author points out that late planting is undesirable because of the material reduction in yield resulting from ripening in hot weather.

A study of spinach varieties, with special reference to their canning qualities, H. B. FARLEY (*Maryland Sta. Bul. 307 (1929), pp. 383–416, figs. 8*).—Of 13 varieties of spinach utilized in the study, the Virginia Savoy was first to show seed stalks in both the overwintered and the spring crop. King of Denmark was the outstanding long-season variety. Records upon the amount of petiole material showed the round-leaved varieties to possess the lowest percentage in relation to trimmed weight. Analysis of records taken in the fall of 1927 at weekly intervals showed the amount of petiole material in proportion to leaf area to be high during early growth and gradually diminishing, with but little change during the time the plants were ready for harvesting. Spaced plants had a smaller amount of petiole material per given leaf area than did crowded plants. Notes on disease resistance and relative hardiness showed Virginia Savoy to be outstanding in both respects. In yields the long-season varieties were low in autumn because of slow development. Flat-leaved varieties outyielded savoy-leaved varieties harvested at the same time.

Concerning the canned product, petioles were more conspicuous in the King of Denmark, Thick Leaved Round, Prickley or Winter, Triumph, Thick Leaved, Giant Eskimo, and Noble Gaudry varieties than in the others. Virginia Savoy, because of blight resistance, gave much less waste in the fall crop. Dark green color in the field was noticeable in the canned product but was not as marked as in the field. The ultimate quality of the product from both overwintered and spring crops was highest in the King of Denmark, Thick Leaved Round, Viroflay, and Virginia Savoy varieties; but when quality and yield are both considered, the first three are recommended. Virginia Savoy is recommended where winter injury is a distinct hazard and for the autumn crop on account of its blight resistance.

The inter-relations between growth of spinach and culture medium reactions, H. H. ZIMMERLEY (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 48–52*).—In experiments at the Virginia Truck Station, Norfolk, no difference was found in either root or top weight of spinach plants grown in nutrient solutions held at pH 5.5 and 6.5. Where pH values of 4, 4.5, 5, and 5.5 were maintained there was noted within the first 10 days a much slower root growth in the pH 4 medium. The taproot ceased elongation at 10 cm. and all subsequent growth occurred at or just above the liquid. Root measurements made 23 and 37 days after placement in the nutrient solutions showed an actual decrease in average length in pH 4 and 29.5, 66.1, and 73.9 per cent increase in the 4.5 5, and 5.5 pH media, respectively. Leaf measurements showed maximum growth at pH 5.5 and least at pH 4, with a sharp increase between 4 and 4.5 and between 5 and 5.5, while the growth rates at 4.5 and 5 were nearly equal. The average green and dry weights per plant of top and roots showed comparable responses. The increase in dry weight of the top and roots is also given for each pH value. In concluding, the author points out that the lower pH limit for optimum growth of spinach was near 5.5, and suggests that the death of root hairs and rootlets at pH 4 may have been due to precipitation of the root cell protoplasm at its isoelectric point.

Inbreeding the Table Queen (Des Moines) squash, E. S. HABER (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 111–114*).—At the Iowa Experiment Station t was found that pure lines of the Table Queen squash (a true pumpkin) could be maintained by self-pollination. Comparing the yield of inbred and of the commercial lines in a single season, the inbred lines yielded an average of 21

ripe fruits per vine weighing 487.9 oz. and the commercial lines an average of 12.7 fruits weighing 274.6 oz., giving evidence that high yielding pure lines of this variety may be secured. Incidentally it was found that a better set of the selfed plants was obtained if no open-pollinated fruits were allowed to mature on the vines.

Studies of tomato quality.—III, Color of different regions of a tomato fruit and a method for color determination, J. H. MacGillivray (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 17-20*).—As determined at the Indiana Experiment Station by the Munsell color system, which specifies color by means of three dimensions, value, hue, and chroma, the outer and inner wall region (E. S. R., 61, p. 441) possessed the best red color. In the case of very ripe Marglobe tomatoes the color was exceptionally good, but the difference between regions was less, leading to the comment that ripest fruits not only possess the best color but differ less between regions. Data on the color of ripe and partially ripe fruits suggest that partially colored tomatoes greatly reduce the color of tomato pulp and should not be used by canners. Differences in color between the raw product and the manufactured pulp are believed due to factory methods or to the inclusion of some partially mature fruits.

Pollination studies in New York State, L. H. MacDaniels (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 117-122*).—Apple breeding investigations conducted at weighing of various factors in the interpretation of pollination results, the author reports on Cornell University experiments with Northern Spy, McIntosh, Rhode Island, and Baldwin apples. Northern Spy was found self-sterile, with Delicious and Rome as satisfactory pollinizers. McIntosh proved self-sterile, with Cortland and Delicious suitable pollinizers. Rhode Island set well with Wealthy, McIntosh, Cortland, and Delicious. Baldwin set a commercial crop with its own pollen under conditions where Rhode Island and McIntosh failed.

That vigor has an important bearing on pollination was shown in a 20-year-old Northern Spy orchard of low vigor. In this case commercial sets were not obtained even with cross pollination. Ringing the limbs with a knife cut failed to exert any significant influence, and variability in response to pollens was much greater than in well-nourished trees. The facts point to the need of extended trials of any given pollinizer before drawing conclusions. The presence of bees or other pollen carriers and the condition of the weather should also be considered.

Progress in apple breeding in Canada, W. T. Macoun (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 117-122*).—Apple breeding investigations conducted at Ottawa, Vineland, Guelph, Saskatoon, Morden, and Summerland are briefly discussed and lead to the following conclusions: (1) That the wild Siberian crab (*Pyrus baccata*) is an important source of hardiness, (2) that seedlings of desired characteristics are best obtained by the use of parents having the most of the same qualities, (3) that quality of parents is needed to give quality in seedlings, and (4) that prepotent parents are desirable, McIntosh being an outstanding example.

Investigations relating to the handling of sweet cherries, with special reference to chemical and physiological activities during ripening, H. Hartman and D. E. Bullis (*Oregon Sta. Bul. 247 (1929), pp. 38, figs. 17*).—Based on five years' work at Corvallis, Hood River, and The Dalles, information is presented on various physiological and chemical activities occurring during ripening.

Cherries increased in weight, size, color, and sugar and solids content during the ripening period, so that time of picking had material influence on yields and quality. The specific gravity of the juice and of the fruit itself increased

during ripening. Acidity and astringency decreased with the approach of maturity. Cracking was found to result from excessive water absorption through the roots or through the epidermis of the fruit itself. Cherries were most susceptible to cracking just before reaching prime condition. Time of picking had no material effect on shipping quality, as tree-ripened fruits usually reached eastern markets successfully. Lambert was the only variety to suffer from loosening of the stems in overripened fruits.

In respect to canning, the time of picking has considerable influence on the quality of the product. Texture was usually firmer in the mature fruits. Later pickings invariably yielded a higher juice cut-out than did early pickings. A close relationship was established between juice cut-out and total sugars of the juice in the canned product and also between juice cut-out and total solids in the raw juice. Fully ripened cherries retained more of their weight and volume upon canning than did immature cherries. Acidity of the juice in the canned product was somewhat more pronounced in the case of immature cherries. The higher the concentration of sirup the greater the loss of weight and volume in the fruit cut-out. The practical application of the results is discussed.

Red currants and gooseberries, G. L. SLATE (*New York State Sta. Circ. 112* (*1929*), *pp. 11*).—Practical suggestions are offered on cultural considerations, use of fertilizers, pruning, control of pests, varieties, etc.

Growth and fruit production studies in the grape, A. S. COLBY and L. R. TUCKER (*Amer. Soc. Hort. Sci. Proc., 25* (*1928*), *pp. 210–216*).—Studies at the University of Illinois upon Kniffin-trained Concord and Moore Early grape vines showed the heaviest production at the second and third nodes of the shoots, gradually reducing to 0 at about the seventh node. The largest clusters were formed on the shoots producing the largest number of clusters. Cluster size (weight) increased from the tip toward the base of the fruiting zone. In Moore Early greatest production was on shoots ranging between 15 and 50 in. in length, with the maximum at 35.5 in. Maximum production in Moore Early was attained in canes of medium diameter, 0.545 cm. Correlation coefficients of 0.6+ observed between berry size and seed number in Concord, Moore Early, and Agawam suggest that size is partially determined by the number of seeds, but other conditions, possibly nutritional, are believed to affect size.

Pruning and fruiting studies of the Concord grape, A. L. SCHRADER (*Amer. Soc. Hort. Sci. Proc., 25* (*1928*), *pp. 217–219*).—This is a further report (E. S. R., 57, p. 240) on a pruning experiment with young Concord vines begun at the Maryland Experiment Station in 1921.

Over a 6-year period, 1923–1928, the highest average annual yield per vine, 325.1 ± 9.67 oz., was produced by vines the main trunk of which was established at the end of the first growing season, with four lateral canes selected at the end of the second season. Data on production after the third season showed the same group to lead, indicating that heavy early production had not reduced bearing capacity in subsequent years. Records of the weight of prunings showed the largest amount of new wood to have been removed from the highest yielding group, indicating no decline in vegetative vigor as a result of early bearing.

Berry thinning of grapes, A. J. WINKLER (*Amer. Soc. Hort. Sci. Proc., 25* (*1928*), *pp. 220–223*).—No measurable differences, except in appearance, were found in studies at the University of California, whether grape clusters were thinned by simply cutting off the lower end or by cutting off all the branches on one side. Early thinning, that is, as soon as possible after berries set,

proved most effective, yielding a 32 per cent increase in berry weight in the Tokay. Similar but smaller responses were obtained with Malaga. Thinning was a material factor in promoting early coloring of the Tokay. In one case thinned plants yielded five times as much ripe fruit at the first harvest as did controls. Coloration was more uniformly distributed over the berries of the thinned clusters. Counts of berries per cluster at harvest showed that the unthinned clusters had lost a considerable number, with little or no such injury to thinned clusters. Thinning reduced the weight and total number of berries per cluster, but not in proportion because of the increased size of berries. The author concludes that berry thinning offers usefulness in vineyards where coloring is poor but not in vineyards where satisfactory fruit is now being produced.

Some responses of the seedless varieties of Vitis vinifera to girdling, H. E. JACOB (*Amer. Soc. Hort. Sci. Proc.*, *25* (*1928*), *pp. 223–229*).—Girdling experiments at the University of California with three varieties of grapes, Black Corinth, Sultanina, and Monukka, showed very considerable increases in yield when the vines were girdled between the beginning of bloom and when the berries were one-fourth grown. Girdling increased the set of berries. Size of berries was materially increased in Black Corinth by all girdlings up to the one-fourth grown stage. In Monukka and Sultanina the greatest effect on berry size (40 per cent in 1928) resulted from girdling when the berries were one-fourth grown. Seasonal variations were noted in respect to the influence of the time of girdling. The mean length of clusters was not affected by girdling, the differences being largely in compactness. With maturity measured by the Balling hydrometer, no hastening of ripening was evident which could be attributed to girdling up to and including the one-fourth grown stage. A slight effect of girdling was observed in the Monukka variety treated when the fruits were beginning to ripen. Only slight differences were observed between trunk and cane girdling; in fact, with the Sultanina variety in 1928, no evidence was obtained in favor of either form.

Fruit-bud development in the tung-oil tree, C. E. ABBOTT (*Jour. Agr. Research* [*U. S.*], *38* (*1929*), *No. 12*, *pp. 679–695*, *figs. 13*).—Cytological examination of the terminal buds collected at frequent intervals from two groups of tung oil trees, one poorly vegetative and the other very vigorous, showed that although the majority of fruit buds differentiate in late June or July this process may occur at any time between May 10 and October 1, depending on weather, culture, and nutritive conditions. In the more vegetative group of trees differentiation was delayed. An abundance of soil moisture also tended to retard fruit bud formation. Evidence was obtained to indicate that the percentage of pistillate blooms is correlated with the vigor of the tree, more female blossoms being produced on vigorously vegetative trees.

Gladiolus varieties, W. W. WIGGIN (*Ohio Sta. Bimo. Bul. 139* (*1929*), *pp. 130–136*, *figs. 3*).—A total of 51 varieties of gladiolus are described and rated as to merit.

FORESTRY

The native and naturalized trees of Illinois, R. B. MILLER and L. R. TEHON (*Ill. Nat. Hist. Survey Bul.*, *18* (*1929*), *Art. 1*, *pp. 339*, *pls. 98*, *figs. 151*).—Supplementing technical descriptions of the trees, foliage, fruit, and wood, notes are given on the distribution in the State and on the uses of the wood.

Oak forests of northern Michigan, J. KITTREDGE and A. K. CHITTENDEN (*Michigan Sta. Spec. Bul.* [*190*] (*1929*), *pp. 47*, *figs. 11*).—This is a general discussion, in cooperation with the Lake States Forest Experiment Station and

the U. S. D. A. Forest Service, of the forestry situation in the scrub oak regions of the northern part of the Lower Peninsula of Michigan, an area originally covered with a mixed stand of Norway and white pines, with oaks as subordinate species.

It was found that natural conversion of oak back to pine is taking place only on a limited area due to the absence of seed pines as a result of repeated fires. The oak is deemed capable of returning a profit of 4 per cent on investment if allowed to grow to maturity, and planted pine, even with the initial cost of from $6 to $10 per acre, is believed capable of returning 5 per cent. Effective fire protection is considered absolutely essential for the upbuilding of the soil, to improve the growth of oaks, and make possible the conversion of oak to pine, whether by natural means or by planting.

Information is presented on the species of oak occurring in the region, tree associations, soil preferences of the several oak species, ground flora indicative of preferred sites, growth of oak in better stocked stands, yields, methods of reproduction in the oak, and planting practices employed in introducing pines into the oak stands.

Growth studies in forest trees: Picea rubra Link, L. W. REES (*Jour. Forestry, 27 (1929), No. 4, pp. 384–403, pl. 1*).—Histological studies upon the red spruce (*P. rubra*) growing on several sites near Wanakena, N. Y., showed first evidence of primary growth appearing as a swelling of the cone buds during the latter part of May. The first secondary growth activity consists of an initial enlargement of the cells in the cambial region of the upper bole. The initial swelling of the leaf buds occurred about mid-June, followed by their opening in the latter part of June. Primary growth began in the surface roots during the latter part of May. Spring wood formation was completed about mid-July, as evidenced by a general decrease in growth activity and the formation of normal resin canals. Cessation of secondary growth was complete by mid-September, and no evidence was secured that a rest period occurred in midsummer. Growth evidently ceased at the same time on the phloem and xylem sides of the cambium layer. Site materially affected the length of the growing period (cell division) and continued longest in the lower slope and spruce flat types.

Yield of jack pine in the Lake States, A. E. WACKERMAN, R. ZON, and F. G. WILSON (*Wisconsin Sta. Research Bul. 90 (1929), pp. [1]+23, figs. 8*).—Tracing the history of the jack pine (*Pinus banksiana*) in the Lake States region and commenting on the distribution, growth, and seeding habits of this species, data are presented in the form of yield, volume, and other tables upon the rate of growth and the yielding capacities upon sites of good, medium, and poor quality. For example, on good, medium, and poor sites fully stocked stands of jack pine 50 years of age were found to be capable of yielding 4,450, 3,500, and 2,550 cu. ft. per acre, respectively. Trees 4 in. and over in diameter on the three sites averaged 7.9, 6.4, and 5.3 in., respectively, in diameter at breast height, and the number of trees per acre above 4 in. in diameter averaged 395, 555, and 690, respectively.

Drainage of swamps and forest growth, R. ZON and J. L. AVERELL (*Wisconsin Sta. Research Bul. 89 (1929), pp. [1]+22, figs. 10*).—Studies in 10 representative drainage areas throughout the State upon the growth of trees located at various distances from the ditches showed that drainage had a uniformly beneficial effect on subsequent timber growth, but the influence was narrowly limited, extending for an average distance of only 150 ft. from the ditch. In some cases growth within this area was accelerated nearly 600 per cent, the range being from 60 to nearly 600 per cent. The greatest benefit occurred in

black spruce and tamarack stands, which changed from an average of ⅕ cord per acre per year before drainage to ⅓ cord afterward. Acceleration was greater in good quality peat than in poor peat, and swamps with shallow and well-decomposed peat were most favorably affected. Drainage increased the increment of cedars from ¾ cord to 1⅓ cords per acre and of young swamp hardwoods from ⅓ to 1¾ cords. It is pointed out, however, that these figures were taken on favorable plats near the ditch. It is concluded that the increased growth resulting from drainage is insufficient to warrant operations with this aim in view, making additional drainage work inadvisable under present conditions.

Effects of forest litter on soil temperature and soil freezing in autumn and winter, A. L. MacKinney (*Ecology, 10 (1929), No. 3, pp. 312–321, figs. 3*).—That leaf litter has a profound influence on temperance relations in the underlying soil was shown in studies conducted in a mixed white and red pine forest near New Haven, Conn., during the autumn and winter of 1927, the records being taken at 6-, 12-, 24-, and 36-in. depths.

Litter delayed the freezing of the soil from December 3 in the open area to January 4 in the litter area. After January 4 the relative rate of frost penetration was the same on both plats, but the maximum penetration in the litter-covered area was 5.8 in. as compared with 8 in. in the bare area. At the same time the character of the frozen soil was affected, that under the litter being porous and allowing water to reach lower levels during rains and thaws, whereas the uncovered soil froze solidly, causing water to run off. Snow was deeper at practically all times on the bare soil.

During the summer and autumn, temperature changes below the surface were less pronounced in the litter area. In winter the snow blanket tended to equalize plats in this respect. Litter raised the maximum, minimum, and mean temperature at all depths during the entire period, the differences being more pronounced in autumn, diminishing during winter, and quite negligible in spring. At all depths there was observed a distinct diurnal fluctuation in temperature.

Damage to Norway and jack pine by red squirrels, E. G. Cheyney (*Jour. Forestry, 27 (1929), No. 4, pp. 382, 383*).—Observations at the Cloquet Forest Experiment Station, Minnesota, showed that red squirrels are capable of injuring Norway and jack pine trees by cutting the tips in winter and early spring. Since this injury was confined to trees of cone-bearing age, the author suggests that the tips are cut to gain access to the cones.

DISEASES OF PLANTS

Contributions to the knowledge of anthracnoses of plants.—I, Notes on three new or little known anthracnoses of the cultivated plants in Japan, T. Hemmi and T. Nojima (*Mem. Col. Agr., Kyoto Imp. Univ., No. 3 (1927), pp. 25–39, pl. 1, figs. 2*).—This report deals with onion smudge caused by *Colletotrichum circinans*; with a new anthracnose of *Aucuba japonica*, due to a fungus described as a new species, *Gloeosporium* (*Colletotrichum*) *kiotoense*; and with the identity which is alleged of the fungus causing poppy anthracnose with an apple bitter rot fungus. Whether this fungus, said to be a Gloeosporium, belongs to *Glomerella cingulata* or not is regarded as unsettled, but it is thought that this may represent a distinct variety or a new species.

Experiments on sex in rust fungi, J. H. Craigie (*Nature [London], 120 (1927), No. 3012, pp. 116, 117, fig. 1*).—To solve the question regarding the occurrence of heterothallism in the rust fungi, the author sowed the sporidia

of *Puccinia helianthi* on leaves of young plants of sunflower and watched for the production of aecia, observing in all about 1,200 monosporidial and 200 bisporidial pustules. The results are detailed.

Discovery of the function of the pycnia of the rust fungi, J. H. CRAIGIE (*Nature [London], 120 (1927), No. 3030, pp. 765–767, figs. 2*).—In experimentation following that reported in the account noted above, the author obtained results, upon the basis of which he states definitely that *Puccinia graminis* is also heterothallic. Proof is also claimed to show that the pycnia (spermogonia) of the rust fungi are not, as often supposed, male conceptacles producing nonfunctional spermatia but active organs having a nonmale function, which they carry out through the agency of flies. Proof is claimed to have been obtained with *P. helianthi* that flies mix the pycnial nectar of separate unisexual pustules and so cause the pustules to change from the haploid to the diploid phase, as shown by the appearance of aecia.

Plant disease, R. A. ALSTON (*Brit. Guiana Dept. Sci. and Agr. Rpt. 1926, pp. 43–46*).—Prolonged and severe drought supposedly hindered the development of disease microorganisms, notably that of *Melanopsammopsis ulei*, and masked the occurrence of vascular diseases.

Sugarcane root disease injury has been lessened considerably in recent years as a result of the adoption of improved methods of tillage. Top rot tends to occur typically toward the close of the normal rainy season, the disease thus appearing to be correlated with the conditions due to a previous subjection of the plants to a long period of wet weather.

Examination of seedling canes suspected to be affected with mosaic showed the occurrence of a chlorosis said to be similar to the noninfectious form, supposed to be a response to unfavorable soil conditions, occurring in 1924 on B. H. 10 (12) in many parts of the Colony.

The plantain and banana disease, said to resemble the moko disease (*Bacterium solanacearum*) of Trinidad, maintained its normal incidence. The local disease affects at least the dwarf banana variety, *Musa cavendishii*. It is stated that in Trinidad moko disease, or bacterial wilt, has been found on plantains, dwarf banana, and Giant Fig. Though resembling symptomatically Panama disease, it is quite distinct from the latter, which is caused by *Fusarium cubense* and which has not yet been proved to exist in British Guiana.

Coffee Sclerotium disease (*S. coffeicolum*) is recorded for the first time as the result of an examination showing its occurrence on the majority of coffee farms in the northwestern district, where it has presumably been present for 10 years.

Notes on two fungicides: Sulphur and Bordeaux mixture, W. GOODWIN and E. S. SALMON (*Jour. Min. Agr. [Gt. Brit.], 34 (1927), No. 6, pp. 517–528*).—To find the best, easiest, and cheapest way of rendering sulfur wettable, laboratory trials were made in 1926, using soft soap at various strengths, alcohol with or without oleic acid, oleic acid alone, casein in various forms, and glue; the practical points being the ease of wetting, the manner in which the sulfur remained in suspension, and the extent to which dilution could be carried out. This work is described and discussed in some detail.

It was found that a suspension of sulfur in a solution of soft soap kills the hop powdery mildew (*Sphaerotheca humuli*), this effect being much more rapid and complete than when the sulfur was applied in the form of powder. As against this disease, finely ground sulfur proved equal to sublimed sulfur.

A method is described of making Bordeaux mixture with calcium hydrate instead of quicklime. Preliminary experiments in 1926 showed that Bordeaux mixture made with hydrate of lime or with quicklime controlled to an equal

extent the attacks of scab (*Venturia inaequalis*) on the foliage of apple trees (Newton Wonder and Allington Pippin) without causing any scorching.

Oat loose smut [trans. title], C. TAMME (*Bot. Arch., 20 (1927), No. 1–2, pp. 43–78, figs. 8; Eng. abs., pp. 72, 73*).—From inoculation studies on oats employing loose smut (*Ustilago avenae*), with particular reference to questions of infection, stimulation, and immunity, the author states that the most protective results were obtained by immersion of the oatseed in formaldehyde at 0.1 per cent strength for 15 minutes. Spraying in the field in 1926 gave unsatisfactory results. Sublimoform applied in the concentration prescribed by the producer, by the steeping or the spraying method, receives favorable mention, as does also Tillantin when employed to steep seed oats for 30 minutes at a strength of 0.2 per cent. No dry applications were found effective. As a result of resistance tests on 15 varieties in 1925 and 14 in 1926, the author recommends Lochow Gelb for heavy soil, Krafft Rheinischer Gelb, and Pfluss Baltersbacher Früh.

Grey speck disease of wheat and oats, W. M. CARNE (*Jour. Dept. Agr. West. Aust., 2. ser., 4 (1927), No. 4, pp. 515–519, fig. 1*).—It is stated that during 1927, for the first time in Australia, this disease of wheat and oats, previously known as white wilt in Western Australia, has been identified with the gray speck disease of oats in Europe and with the roadside take-all of South Australia. In Western Australia it is associated with so-called brown mallet (*Eucalyptus astringens*) or with wandoo (*E. redunca elata*), where this has supposedly replaced mallet. The yellow or whitish grain patches on the hill-sides appear in June or July, and these spots either recover to show later nearly normal plants or else fail if unsuitable climatic conditions prevail in August or September. The disease has been experimentally controlled by certain chemical treatments, but these are as yet too expensive to be practical. Present evidence indicates that the disease is definitely reduced by cropping not more than once in four years.

Root-rot and foot-rot of wheat, W. M. CARNE (*Jour. Dept. Agr. West. Aust., 2. ser., 4 (1927), No. 4, pp. 483–488, figs. 2*).—Of root rotting diseases in Australia, the best known is take-all, due to *Ophiobolus graminis*. Two diseases showing more or less closely similar characters are caused by *Helminthosporium sativum* and *Wojnowicia graminis*, and these are for convenience in distinction designated as foot rot and root rot, respectively. All three diseases are briefly described, as are conditions and measures favorable to control, which are said to be the same for root rot and foot rot as those which have proved successful with take-all. The most essential features are early and clean fallowing, and rotation with oats.

Pathological symptoms in legumes caused by the potato leaf hopper, J. MONTEITH, JR., and E. A. HOLLOWELL (*Jour. Agr. Research [U. S.], 38 (1929), No. 12, pp. 649–677, pl. 1, figs. 13*).—Field observations in 1926 and 1927 are said to have indicated that several forage crop legumes suffered severely from attacks of the potato leafhopper (*Empoasca fabae*). The injuries caused by this leafhopper to forage legumes appeared to be worst throughout the Clover Belt and southward.

Reports are given of experiments conducted at the Arlington, Va., Experiment Farm and the Illinois Experiment Station to determine the symptoms and the extent of the injuries produced by potato leafhoppers on medium red clover, white clover, Ladino clover, alsike clover, zigzag clover, alfalfa, sweet-clover, cowpea, soybean, lotus, and garden bean. In these experiments plants in the field and in greenhouse pot cultures were inclosed in wire nettings, and

one cage was kept free from insects and the other infested with potato leafhoppers.

The symptoms produced on legumes are said to include the common tip and marginal browning known as hopper-burn, as well as a conspicuous reddening, bronzing, and yellowing of leaves, petioles, and stems. There was usually a pronounced dwarfing of the plant, curling of the leaves, and check in floral development.

The yields of hay or forage were reduced by leafhoppers, and evidence was secured to indicate that the insects may be an important factor in reducing or destroying stands of clover, alfalfa, and perhaps other forage crops. It is believed that seed production may also be decidedly restricted by them.

The authors state that the damage caused to plants by this insect is the result of some disturbance of the metabolic processes of the plant due to the injection of an enzyme or toxin, which apparently remains more or less localized.

Plants were found to succumb to leafhopper injury most rapidly in hot, dry weather, and the greatest damage was observed during periods of heat and drought. During excessive rainfall, lower temperatures, and high humidity the leafhoppers were found to decrease in numbers. The insects were found to migrate when the food supply became limited, and a difference of a few days in the date of planting or the time of cutting is believed to influence the damage they cause to a crop.

Studies on Sclerotium rolfsii, with special reference to the metabolic interchange between soil inhabitants, H. R. Rosen and L. Shaw (*Jour. Agr. Research* [*U. S.*], *39* (*1929*), *No. 1*, *pp. 41–61*, *figs. 7*).—On account of serious losses to cantaloupes in Arkansas in 1928, due to attacks of *S. rolfsii*, the authors made an investigation of *S. rolfsii* and *Fusarium vasinfectum*, soil infesting organisms, to determine their habits of growth and possible effects on each other when grown together. *S. rolfsii* was found to grow readily on the paper wrappers of the cantaloupes, using the cellulose for the nutrition of the fungus.

Studies on the growth of *S. rolfsii* on potato dextrose agar at various H-ion concentrations showed that the fungus was markedly tolerant of acid conditions and quite sensitive to alkaline reactions. A noticeable gradient was observed in the sclerotial development on acid media. Beginning with pH 8 and extending upward, sclerotia failed to germinate on this medium.

The other soil inhabitant studied, *F. vasinfectum*, grew well on this medium throughout the range of H-ion concentration from pH 3 to pH 9.

F. vasinfectum was grown on potato dextrose agar having alkaline reactions of from pH 8 to pH 9, and when reinoculated with *S. rolfsii* an abundant growth of the latter fungus was observed. Both fungi were grown on a commercial dehydrated potato dextrose agar, and it was concluded that the OH-ion content by itself was not as highly specific in inhibiting growth of *S. rolfsii* as was indicated in the former experiments. *F. vasinfectum* was found to be well adapted to growth on the dehydrated medium. When the two fungi were grown simultaneously on the same plate, *S. rolfsii* completely outgrew and in time covered the *Fusarium* in the acid media below pH 6.9. When the medium was neutral and in the alkaline ranges the reverse phenomenon occurred. With the introduction of *S. rolfsii* into plates that had previously sustained growth of *F. vasinfecium*, dehydrated media, originally rendered alkaline, permitted the germination of sclerotia in time intervals that were considered unsuitable for germination when *S. rolfsii* was grown by itself. Negative chemotropic responses were noted in *S. rolfsii* on media originally possessing acid reactions

which had, prior to the introduction of this fungus, been used for growing *F. vasinfectum*.

It was found that the type and quantity of inoculum of *S. rolfsii* were very important factors in overcoming reactions that were unfavorable to the germination and growth of sclerotia.

Potato leaf roll [trans. title], G. SCHWEIZER (*Ber. Deut. Bot. Gesell., 44 (1926), No. 9, pp. 551–561, figs. 5*).—The author studied the effects of certain substances, both organic and inorganic, when applied to living organisms, here specifically potato plants affected with leaf roll or free from that trouble, and in pot culture as well as in the field. Both gross and minute results are described, with suggestions, of the effects of supplying to the plant certain materials, of which pepsin is credited with having promoted effects culminating in apparently complete return to normalcy in leaf roll potato plants. The results relate to the degree of dispersion both of starch and of bacteria.

Transmission experiments with virus diseases of the potato (Solanum tuberosum) by insects, D. L. ELZE (*De Verspreiding van Virusziekten van de Aardappel (Solanum tuberosum L.) door Insekten. Proefschr., Landb. Hoogesch., Wageningen, [1927?] pp. VIII+87+[2], pls. 2, fig. 1; Eng. abs., pp. 61–65*).—Of the insects tested, including *Myzus persicae*, *M. pseudosolani*, *Aphis rhamni*, *A. fabae*, *Eupteryx auratus*, *Typhlocyba solani*, *Lygus pratensis*, *Psylliodes affinis*, and *Mamestra brassicae*, all carried one or more virus diseases, although aucuba mosaic was not transmitted in any case. The evidence indicates that little importance, as carriers of mosaic, is to be attributed to those insects which increase in late summer.

The rate of spread of potato virus diseases in western Nebraska, R. W. GOSS (*Jour. Agr. Research [U. S.], 39 (1929), No. 1, pp. 63–74, figs. 2.*).—A report is given of investigations carried on during 1924 to 1927, inclusive, on the relative spreading of leaf roll, mild mosaic, rugose mosaic, and spindle tuber in potatoes grown under irrigation.

Mild and rugose mosaic were found to be transmitted in small amounts in only two of the four years of the experiment, and their spread was correlated with the occurrence of aphids.

Leaf roll was transmitted slightly more extensively, but the disease spread only to a distance of about three hills from possible sources of infection. The spread of leaf roll was found to be correlated with aphid transmission except in 1926, when other insects were probably involved.

Spindle tuber was found to be transmitted more extensively, and it was present to the extent of 42.4 per cent after four years. Transmission occurred in all four years, but was more abundant in 1925 and 1927, when aphids were present. It is believed that the spread of the disease could also be correlated with the presence of grasshoppers, although other insects may have been involved. None of these diseases were spread more than a few rows from the sources of infection.

Of the four diseases studied, the author considers spindle tuber the most serious under the conditions of the experiment, although there was some evidence that leaf roll might become a serious problem if it should once become established.

Breeding of immunity in potatoes [trans. title], G. O. APPEL (*Pflanzenbau [Berlin], 4 (1927), No. 4, pp. 51–58*).—This account is largely historical.

Sclerotium disease of tomato and pepper, M. ATIENZA (*Philippine Agr., 15 (1927), No. 10, pp. 579–588, pls. 2, fig. 1*).—*S. rolfsii* is said to be common in the College of Agriculture fields at Los Banos, Laguna, P. I., during the rainy season and to cause seedling damping-off, wilt, blight, fruit rot, and root rot of tomato, pepper, and other plants. Some conditions are described.

Sclerotial bodies are the chief means of carrying over and sources of inoculum in the field. They are rendered harmless if buried 2 cm. deep. The further relations of depth of burying to viability are not yet worked out.

The disease may be controlled by sanitation, with employment of such agents as lime, sulfur, copper stearate, Corona 640, and Uspulun.

A preliminary note on a theory as to the origin of bitter pit in apples, W. M. Carne (*Jour. Dept. Agr. West. Aust., 2. ser., 4 (1927), No. 3, pp. 382–385*).—As the outcome of theorization and experimentation indicated, the author, basing his views mainly on a study of the very susceptible variety Cleopatra, considers apple bitter pit as "a necrosis (death of cells) of immature starch-filled tissues of rapidly growing apples, resulting from excessive transpiration, followed by osmotic action between the starch-filled cells and those in which the starch has been largely or completely changed to sugar."

Excessive transpiration on the tree is said to be related mainly to periods of bright sunshine and low humidity. It may or may not be associated with soil moisture deficiency. It is further related to the size and rapidity of growth of the fruit and to the ability of the tree to furnish sufficient supplies to the fruit to meet the losses of water during periods of high transpiration. Excessive transpiration in storage is related to the size of the fruit and to the fact that it is cut off from its moisture supplies. The difference between cold and ordinary storage is one of relative rates of transpiration and rates of maturation.

Immature tissues are defined as those in which the cells still contain starch. Bitter pit does not develop in either mature or ripe fruit, maturity being defined as that point of development at which the tissue cells no longer contain starch. Mature fruits are not yet ripe.

The period of susceptibility to bitter pit extends from an early stage of the fruit development, when sugar first appears in some of the cells, to maturity. Susceptibility is greatest when the fruit is growing rapidly, and liability is greatest when the susceptible stage is developed during conditions most conducive to transpiration, i. e., in Australia during January, February, and March. The difference in susceptibility of varieties is in part due to differences in the rate of fruit growth and to the ability of the tree to supply deficiencies of moisture, and in part also to the critical periods of susceptibility in different varieties being passed under different conditions of temperature and humidity.

The occurrence of bitter pit in early shipments of susceptible varieties is said to be due to the picking of the larger terminal apples first, on the supposition that these are the first to mature, when they are really among the last to mature on a tree if free from moldy core or parasitic infection. The common occurrence of pit in the large terminal fruit, the large fruits of young trees, or the large fruits of light crops on old trees is said to be due to rapid growth, large transpiring surfaces, late maturity, and early picking.

It is thought that bitter pit originates in storage as well as on the trees. It ceases to develop with approaching maturity. Bitter pit tissues contain starch. Ripening in apples is known to be uneven. As the ripening areas (cells free from starch) extend outward, pit, if developed, would be more and more superficial.

As to the practical bearings, the theory would suggest that at thinning time the terminal fruits (center fruits of clusters) should be removed. The larger the fruit the later it should be picked. Picking should be delayed until the fruits approach maturity. Fruit should go into cold storage as soon as possible after picking.

Bitter pit in apples: Its occurrence in store in relation to dates of picking, G. W. Wickens and W. M. Carne (*Jour. Dept. Agr. West. Aust., 2. ser., 4 (1927), No. 3, pp. 354–357*).—A condensation is offered of the review of the bitter pit situation by Smith (E. S. R., 57, p. 650).

***Brown rot of apples: The need for careful* picking *and* sorting,** H. Wormald (*Jour. Min. Agr. [Gt. Brit.], 34 (1927), No. 6, pp. 552–554, pl. 1*).—In recent years fruit brown rot (*Sclerotinia fructigena*) has been very prevalent. It was particularly severe in 1926, being common not only on apples and pears (its usual hosts), but also on plums, which showed considerable loss from this cause. As *S. fructigena* appears to be a wound parasite, insistence is made upon safer modes of handling the fruit and the destruction of all carrying-over material.

The perfect stage of Hendersonia mali, L. R. Hesler (*Mycologia, 19 (1927), No. 4, pp. 222–227*).—Apple twigs collected some years previously at Hemlock Lake, N. Y., bore *H. mali*, and accompanying this conidial form were found also perithecia, asci, and ascospores characteristic of the genus Pleospora. Growth resulting from ascospore cultures yielded conidia of Hendersonia agreeing morphologically with those on the apple twigs. Further study of the ascomycete is said to have shown the fungus to be a new species, and this is described as *P. mali*.

Canker in Fertility pear trees, H. Wormald (*Jour. Min. Agr. [Gt. Brit.], 34 (1927), No. 2, pp. 162–165, pl. 1*).—Two interplanted sets of pear trees were grown on similar series of quince and free pear rootstocks, one set as standards with stem length of 4.5 ft., the other as bush trees with stem length of 2 ft., the only other difference being that the bush trees had, annually, the leading branches tipped and the laterals spurred. It was found that the standard trees were seriously crippled by canker, the bush trees being practically free from it. It is thought that the grower of Fertility pears has two alternatives, either to grow bush trees on which the normal operations of leader tipping and pruning indirectly reduce the liability to scab infection and subsequent canker; or else to grow standard trees, which can not be so economically or effectively pruned and sprayed, and which will also need considerable attention to keep them free from cankering.

These observations are considered to show how much more effectively canker in Fertility pears can be controlled when the variety is grown as a regularly pruned bush; and that this pruning factor, rather than the choice of stock, determines the production of healthy trees. With standard trees, special attention must be given to spraying operations, requiring in this case high pressure. Bordeaux mixture is safe and the best fungicide for scab. The first spraying should be carried out just before flowering and the second immediately after the fruit is set. Later spraying should not be omitted if the trees have been seriously infected the previous year or when subsequent canker infection is feared. If cankers appear, they should be cut out at once.

Lithiasis and bitter pit of pears, W. M. Carne (*Jour. Dept. Agr. West. Aust., 2. ser., 4 (1927), No. 2, pp. 202–206, figs. 4*).—The condition designated as lithiasis is described as long known in Western Australia, but only recently serious economically in that State. It is thought possible that pear bitter pit, as here described, is closely allied to pit and crinkle in apples, which are said to be still of unknown causation.

Scaly bark (psorosis) of citrus trees (*So. African Fruit Grower and Smallhold., 14 (1927), No. 5, pp. 105, 107, figs. 2*).—Information taken from a bulletin accredited to E. M. Doidge outlines the symptoms and causation of citrus tree psorosis, the history of the disease, and the treatment employed in

California, with reference to Fawcett (E. S. R., 49, p. 649) and mention also of the policy advanced by Webber (E. S. R., 57, p. 141).

[Diseases of musaceous crops, British Guiana], J. S. Dash (*Brit. Guiana Dept. Sci. and Agr. Rpt. 1927, pp. 5–7*).—The only diseases of plantains and bananas which have been reported as occurring in this Colony are a bacterial disease affecting plantains and at least the dwarf or Chinese banana (*Musa cavendishii*); Surinam disease or elephantiasis (*Ustilaginoidella oedipigera*), distinct from Panama disease and of little economic importance; and anthracnose of banana fruits due to *Gloeosporium musarum*. Though Panama disease is not known at present in British Guiana, suspicious cases of wilt have occurred in the Gros Michel (Jamaica or Martinique) banana.

A new leaf spot of pecan, O. C. Boyd (*Ga. State Bd. Ent. Circ. 40 (1928), pp. 8*).—This pecan disease, observed by the author during work previously noted (E. S. R., 58, p. 853) in the summer and fall of 1926, and again during 1927, has been found to attack Delmas, Moneymaker, Stuart, Frotcher, Van Deman, Schley, Alley, and Mobile. Common varieties not attacked include Moore, Success, Tesch, and Pabst. Areal incidence for 1927 includes nine counties, which are named. This disease may become a limiting factor in nut production. The symptoms are particularized. The organism, as yet only partly studied, resembles both Cercosporella and Cylindrosporium (*C. caryigenum*). The name yellow leaf spot has been temporarily assigned to the disease, although frosty mildew and brown spot are also descriptive in certain stages.

Evidence appearing incidentally during the scab-control tests points to limited yellow leaf spot control values in sulfur and copper dusts and in Bordeaux sprays.

Studies on septorioses of plants.—I, Comparison of two different species of Septoria causing the leaf-spot diseases of the cultivated chrysanthemum, T. Hemmi and H. Nakamura (*Mem. Col. Agr., Kyoto Imp. Univ., No. 3 (1927), pp. 1–24, pls. 2, figs. 4*).—Cultivated chysanthemum in Japan and probably also in several other countries is attacked by *S. chrysanthemella*, causing the black spot disease, and by another Septoria which the authors claim should be designated as *S. obesa*, causing the brown spot disease. In the present paper the morphology and cultural characters of these two fungi are compared, with a report of the results of inoculation tests of the two fungi.

A witches' broom on Cydonia japonica [trans. title], E. Heinricher (*Ber. Deut. Bot. Gesell., 46 (1928), No. 3, pp. 198–204, figs. 3*).—It is stated that in the Innsbruck Botanical Garden there was observed on *C. japonica* during 1914 and until 1927 a typical witches' broom quite similar to that caused on cherry by *Exoascus cerasi*. The exact classification of the causal organism in the present case was not ascertained.

An important virus disease of Lilium longiflorum and its varieties, L. Ogilvie (*Nature [London], 119 (1927), No. 2997, p. 528*).—The author claims to have shown by controlled experiments that an important disease occurring on *L. longiflorum* and on its varieties *L. longiflorum takesima*, *L. longiflorum insulare*, and *L. longiflorum eximium*, pertains to the group of filtrable viruses, utilizing as carrier *Aphis lilii* (closely akin to *A. gossypii*).

The symptoms are a marked downward curling, a slight chlorosis of the leaves, and a flattened rosette, this latter feature giving rise to the name yellow flat, applied to the disease. The trouble occurs commonly among bulbs of oriental origin. It is stated that rigid government inspection in the Bermuda lily fields of *L. longiflorum eximium* has rendered the incidence of this disease negligible.

Biological-morphological studies on Erysiphaceae [trans. title], A. Buchheim (*Ber. Deut. Bot. Gesell., 46 (1928), No. 3, pp. 167–180, figs. 4*).—This account involves particulars regarding the influence of external factors on the formation of perithecia, the forms affecting *Caragana arborescens* and *Robinia pseudacacia*, and the perithecia of oak mildew. Besides considerable variability in other respects of the perithecia of oak mildew, a tendency is noted for such perithecia in a given place to decrease in size from year to year.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Birds of Alabama, A. H. Howell (*Montgomery: Ala. Dept. Game and Fisheries, 1928, 2. ed., pp. 384, pls. 7, figs. 31*).—This is a second edition of the work previously noted (E. S. R., 51, p. 549).

Woodpeckers, nuthatches, and creepers of New Jersey, L. A. Hausman (*New Jersey Stas. Bul. 470 (1928), pp. 48, figs. 43*).—This is a practical account of the woodpeckers, nuthatches, and creepers occurring in New Jersey. Descriptions are given of the adults of 10 forms of woodpeckers, of 2 nuthatches, and the brown creeper, followed by accounts of their habits and range within the State. Food charts, a comparative chart of the dietaries of the native woodpeckers, a key to the adult woodpeckers of the State, and a chart showing the relative sizes of the birds considered are included.

An apparatus for the study of comparative effects of constant versus variable temperatures on the speed of insect metabolism, T. J. Headlee (*Jour. N. Y. Ent. Soc., 37 (1929), No. 1, pp. 25–29, figs. 2*).—In studies conducted at the New Jersey Experiment Stations with a view to arriving at an understanding of the relationship between the effects of variable and constant temperatures, the author constructed a piece of apparatus which is here described. Through its use the variables other than temperature have been reduced to zero or at least to a negligible point, permitting direct experimentation with a controlled constant v. a controlled variable temperatnre.

Some facts relative to the effect of high frequency radio waves on insect activity, T. J. Headlee and R. C. Burdette (*Jour. N. Y. Ent. Soc., 37 (1929), No. 1, pp. 59–64*).—In work at the New Jersey Experiment Stations insects were found to be killed when exposed to high frequency waves of 24 meters and 12,000,000 cycles per second with the ammeter reading about 1.75 amperes. This lethal effect was due to the development of an internal heat of lethal degree.

"Nervous reaction speeds up at the rate of producing this internal lethal heat, and the more specialized the nervous tissue the greater is the increase in speed of reaction. All organic chemical compounds with which the writers have worked and which are more or less characteristic of living tissue show ability to increase in internal heat when subjected to the above high frequency waves, and of all these organic compounds with which work has been done cholesterol stands out preeminently in this respect. Cholesterol is characteristic of nervous tissue."

Insecticidal value of pyrethrum soaps, E. N. Cory and N. A. Eaton (*Maryland Sta. Bul. 308 (1929), pp. 415–428*).—This is an account of experiments conducted with two commercial pyrethrum soaps, the first given the trade name Kilspray, then the name Insektospray, and finally, because these names were preoccupied, the name Red Arrow, by which it is now known. The second soap was Pyrethrol. Both of these pyrethrum soaps contain practically the same materials, although in widely different proportions, and both owe their activity principally to the alcoholic oleoresin of pyrethrum made by the usual

processes of percolation and concentration. The former is made by mixing the oleoresin, approximately 40 per cent with 30 per cent of soap, while Pyrethrol is a concentrated form of sodium oleate oleoresin of Pyrethrum Spray, developed at the U. S. D. A. Japanese Beetle Laboratory, Riverton, N. J., and consists of oleoresin 4 per cent, oleic acid soap (sodium oleate) 47 per cent, and water 49 per cent.

The experiments conducted, the details of many of which are presented in tabular form, have shown Insektospray (Red Arrow) to be toxic to the spirea aphis (*Aphis spiraecola*), cabbage aphis (*A. brassicae*), chrysanthemum aphid, green peach aphid, white fly (*Asterochiton vaporariorum*), citrus mealybug, Mexican bean beetle, asparagus beetle, elm leaf beetle (*Galerucella luteola*), squash beetle, 12-spotted cucumber beetle (*Diabrotica 12-punctata*), fall webworm, German cockroach, stable fly, and mosquito larvae (*Culex quinquefasciatus*). With the possible exception of the mosquito larvae and the mealybug, Insektospray could be used economically to control these insects. Against mosquito larvae the dilutions greater than 1:2,000,000 may be effective. At that dilution no effect was noted after drinking the water and the presence of Insektospray could not be tasted or smelled.

It was found that Pyrethrol could be economically used against aphids. Judging from the amount of soap which it contains, it could be effectively used against any soft-bodied insects.

Insektospray and nicotine were compared in exactly the same dilutions on two insects. On one, Insektospray was shown to have the higher killing efficiency at a given dilution, while on the other Blackleaf 40 was shown to be more effective.

Studies on the toxicity of hydrocyanic acid, J. B. Allison (*Iowa State Col. Jour. Sci., 2 (1928), No. 4, pp. 243–252, figs. 5*).—This is a report of experiments conducted on the toxicity of hydrocyanic acid for the weevil, cockroach, and rat.

Common pests of field and garden crops, R. H. Pettit (*Michigan Sta. Spec. Bul. 183 (1929), pp. 77, figs. 53*).—This is a revision of Special Bulletin 132 previously noted (E. S. R., 51, p. 452), in which some additional material has been added to the discussions of certain pests, and several new topics have been added to the ones previously considered.

[Seventh biennial report of the Montana State Board of Entomology, 1927–1928] (*Mont. State Bd. Ent. Bien. Rpt., 7 (1927–28), pp. 88, figs. 14*).—This report (E. S. R., 58, p. 451) consists of a foreword by the acting secretary of the board, J. R. Parker (pp. 7, 8); an obituary account of R. Kerlee, who succumbed to Rocky Mountain spotted fever while engaged in the investigation of the disease (p. 9); and the following papers: Tick Parasites (pp. 10–16) and Preliminary Report on the Tick Parasite *Ixodiphagus caucurtei* Du Buysson (pp. 17–31), both by R. A. Cooley; Quantity Production of Tick Parasites, by F. A. Morton (pp. 32–35); Tick Parasite Liberation in Montana during 1928, by J. R. Parker and W. J. Butler (pp. 35–38); Rocky Mountain Spotted Fever, which includes a list of 64 references to the literature (pp. 39–62), Rocky Mountain Spotted Fever in Montana, 1927–1928 (pp. 63–67), and Vaccination against Rocky Mountain Spotted Fever (pp. 68, 69), all by R. R. Parker; A Short Review of the Work of the United States Public Health Service on Rocky Mountain Spotted Fever, by W. F. Cogswell (pp. 69, 70); Control Work: Rocky Mountain Spotted Fever Control Districts, Bitter Root Valley, 1927–1928, by F. J. O'Donnell (pp. 70–75); Tularaemia and Tick Paralysis (p. 76); Results of Preliminary Investigations in Montana of Pathological Conditions in Sheep Due to the Wood Tick, *Dermacentor andersoni*

Stiles, by R. R. Parker and W. J. Butler (pp. 77–85); and Montana's Laboratory for the Study of Insect-Borne Diseases, by R. A. Cooley (pp. 86–88).

Report of the imperial entomologist, P. V. Isaac (*Agr. Research Inst., Pusa, Sci. Rpts., 1927–28, pp. 71–78.*)—This, the usual annual report on the work of the year (E. S. R., 59, p. 456), includes an account of the occurrence of some of the more important insect pests.

[Economic insects in Egypt] (*Agr. Jour. Egypt, n. ser., [2] (1924–1925) [issued 1928], pp. 73–85, 111–136, pls. 3*).—The papers included are as follows: A Recent Introduction of a Beneficial Insect into Egypt: The Australian Ladybird Beetle (*Cryptolaemus montrouzieri* Muls.), by A. M. Mistikawy (pp. 73–79); The Use of Arsenical Preparations against Cotton Pests in Egypt, by C. B. Williams (pp. 81–85); and The Mediterranean Fruit Fly, by Abdel Aziz Eff. el Ghawabi (pp. 111–136).

The Mediterranean fruit fly is said to have become of practical importance during the last three years because of the great damage done to fruits, infesting many, both hard and soft, acid and sweet, thin and thick skinned. In his account of the pest, Ghawabi lists its important hosts in Egypt, which include the apricot, peach, guava, mango, plum, apple, pear, quince, citrus, figs, Chinese dateplum, papaw, and pomegranate (pp. 122–127).

Two experiments in peach orchards for the control of the pest are reported, in which arsenate of lead was used at the rate of 6⅔ oz., unrefined sugar 12 rotles (Egyptian pounds), and water 72 liters. The application of this poison spray by the use of a compressed air sprayer was started May 5 and 6 in two gardens containing 220 and 183 fruitful peach trees, respectively. The author was led to conclude that the application of such a poison spray is very effective in controlling the pest. The first application should be made when the fruits liable to the attack are more than two-thirds grown. This treatment should be renewed after any rain and at frequent intervals, varying from 15 to 20 days with the season and the prevalence of the pest in the treated locality. Spraying should be continued until the susceptible fruits are all off. The number of applications varies with the kind of fruit, the season, and the local conditions, but with all kinds of fruits is said to vary from 2 to 6. The cost was reduced by using sodium fluosilicate and diminishing the quantity of sugar.

The successful results obtained led to the organization of campaigns against the pest on a large scale. It was found that the adults from infested fruit that was burned could not make their way through a foot of well-tamped soil. Experiments showed that submergence in water for five days will kill or so injure the larvae that they will not develop, and that in seven days all pupae will be dead. Fruit which has been under water for seven days is rendered unfit for feeding larvae. To make sure of killing all immature stages of the Mediterranean fruit fly, the infested fruit should be submerged for more than seven days.

Report of the entomologist, C. Smee (*Nyasaland Dept. Agr. Ann. Rpts. 1926, pp. 13–20; 1927, pp. 19–22*).—The occurrence of and work with insects during the year are considered, particularly those affecting tobacco, tea, and coffee.

[Entomological research in the Sudan] (*Sudan Govt., Agr. Research Rpt., 1926–27, pp. 113–119*).—The several brief reports on entomological work conducted in the Sudan are as follows: Work of the Entomological Section, by H. H. King (pp. 113, 114); Pest Report for the Gezira Research Farm for the Season 1926–27, by H. B. Johnston (pp. 114–117); and Chemical and Entomological Research Programme for the Gezira for the Season 1927–28 (pp. 118, 119).

Insect enemies of alfalfa [trans. title], P. P. GRASSÉ (*Prog. Agr. et Vitic. (Éd. l'Est-Centre), 50 (1929), Nos. 10, pp. 235, 236, pl. 1; 14, pp. 335–340*).—This is a practical account, accompanied by a colored plate, of the more important insect pests of alfalfa in France.

Preliminary experiments with dusting and spraying against insect pests of cotton, I. EFF. BISHARA (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 77 (1928), pp. 11, pls. 3*).—In control work with the pink bollworm, sodium fluosilicate mixed with an equal volume of flour was applied as a dust in the early morning while the dew still remained on the plants. It gave a reduction in bollworm infestation averaging about 54 per cent, that of the pink bollworm being 53 per cent and that of the spiny bollworm (*Earias insulana*) 66 per cent. It is thought that the larva secures the poison while crawling on the plant immediately after hatching in search of a suitable bud or boll. No burning of the cotton plant followed the application of the sodium fluosilicate, and the plants were free from the aphid attack which usually follows dusting with arsenicals.

Mineral oils having caused a scorching of the cotton plant, experiments were conducted with castor oil, which was shown to be decidedly repellent to both bollworms, its effect being directly related to the amount of oil used. The castor oil treatment is rather costly, but it is thought that it may be profitable to use.

Dusting work with calcium arsenate against the pink bollworm demonstrated that a much better control could be obtained with sodium fluosilicate. The application of sodium fluosilicate for the control of the cotton leaf worm (*Prodenia litura*) resulted in 100 per cent mortality in a single night. Newly hatched larvae on dusted leaves were killed before feeding, apparently by mere contact with the dust.

[Report of work on sugarcane insects] (*Queensland Agr. Jour., 30 (1928), No. 6, pp. 510–512, 513–516, 518–522; 31 (1929), No. 2, pp. 100–110*).—Several brief reports on work conducted in Queensland are presented, including Biological Control of Caterpillars Attacking Sugar Cane, by E. Jarvis (pp. 510, 511); Relationship between Insect Attack and Plant Failure (pp. 511, 512) and Cane Grub Activity (pp. 513, 514), both by R. W. Mungomery; Entomological Hints to Canegrowers (pp. 514–516) and Biological Control of Cane Insects (pp. 518, 519), both by E. Jarvis; Field Experiments against Grub Infestation, by A. N. Burns (pp. 520–522); Entomologist's Advice to Canegrowers, by E. Jarvis (pp. 100, 101); Cane Pests and Diseases, by A. N. Burns (pp. 102–105) and R. W. Mungomery (pp. 105–108); and Cane Pest Combat and Control, by E. Jarvis (pp. 108–110).

Caterpillar enemies of the plum tree [trans. title], J. FEYTAUD (*Rev. Zool. Agr. et Appl., 27 (1928), No. 7, pp. 110–114, fig. 1*).—A brief account is given of the more important lepidopterous enemies of the plum in France.

Worm pests of the plum [trans. title], J. FEYTAUD (*Rev. Zool. Agr. et Appl., 27 (1928), No. 12, pp. 181–189, figs. 2*).—A brief account of the more important insects the larvae of which attack the plum.

Pests of the tea plant in the Dutch East Indies (Java and Sumatra) and their control [trans. title], R. MENZEL (*Arch. Theecult. Nederland. Indië, No. 1 (1929), pp. 66, pls. 41, figs. 8; Eng. abs., pp. 64–66*).—This is a summary of information on the more important enemies of tea, principally in Java and Sumatra, and of the means for their control.

Tea mosquito bug in Nyasaland (Helopeltis bergrothi Reut.) and notes on two potential pests of tea, C. SMEE (*Nyasaland Dept. Agr., Ent. Ser. Bul. 4 (1928), pp. 10, pls. 5*).—In addition to a report of studies on the tea mosquito

bug (*H. bergrothi*), brief accounts are given of the tea leaf weevil (*Dicasticus mlanjensis* Mshl.) and the bean flower capsid (*Callicratides rama* Kirby).

Thrips as carriers of fig-decaying organisms, H. N. Hansen (*Science, 69* (*1929*), *No. 1787, pp. 356, 357*).—In a study of the losses suffered by fig growers from various rots, decays, and fermentations, several thousand uncaprified, hard, green figs collected by the author in May, 1928, were cut into halves and examined for evidence of insect invasion, mutilated and discolored floral parts, insect excreta, or the insects themselves. Slightly in excess of 20 per cent of the figs examined were found to be infested with thrips, specimens of which were identified by D. Moulton as *Thrips tabaci* Lind. and *Frankliniella* sp., probably *F. californica* Moul. Each of the 200 thrips-infested figs yielded one or more of several species, representing 7 genera of fungi, bacteria, and a number of yeasts. The 10 figs showing no evidence of insect invasion yielded no cryptogamic flora in culture. The results showed that when green, hard figs are entered by thrips they become inoculated with organisms capable of producing various decays and fermentations in the ripening fruit.

Progress report on the Coccinellidae imported from Trinidad to control Aspidiotus destructor, T. H. C. Taylor (*Agr. Jour.* [*Fiji*], *1* (*1928*), *No. 1, pp. 7–10; also in Trop Agr.* [*Ceylon*], *72* (*1929*), *No. 1, pp. 55–57*).—This is a brief summary of Trinidad coccinellids, which are considered to promise well in *A. destructor* control in Fiji. *Cryptognatha nodiceps* Mshl., the most promising species, is considered to be established in Fiji.

New insect enemies of the citrophilus mealybug from Australia, H. S. Smith and H. Compere (*Calif. Dept. Agr. Mo. Bul., 18* (*1929*), *No. 3, pp. 214–218*).—An investigation by the junior author resulted in the discovery of the citrophilus mealybug on Choysia and oleander in the botanical gardens of Sydney, Australia, and a further search resulted in the discovery of several enemies. Six species of parasites and predators were introduced into California, and their establishment is under way. In a visit to New Zealand this mealybug was found to occur commonly and to be a serious pest of deciduous fruits.

The Mediterranean and other fruit flies, H. J. Quayle (*California Sta. Circ. 315* (*1929*), *pp. 19, pl. 1, figs. 14*).—This is a practical account of the more important fruit flies that may be introduced and become serious pests in California, with particular reference to the Mediterranean fruit fly and the means of distinguishing this pest from other insects occurring in the State in sound or decayed fruits. The account includes drawings of fruit fly larvae, by means of which they may be identified. Among the species included are the Mediterranean fruit fly, Mexican fruit fly, currant fruit fly (*Epochra canadensis*), walnut husk fly (*Rhagoletis juglandis*), *Euxesta notata, Lonchaea occidentalis*, and the pomace fly. Appended is a list (pp. 18, 19), furnished by H. M. Hall, of the fleshy-fruited California plants that might have a bearing upon a possible campaign of eradication in case the Mediterranean fruit fly should appear in the State.

The Mediterranean fruit fly [trans. title], **J. Vayssière** (*Rev. Zool. Agr. et Appl., 27* (*1928*), *Nos. 9, pp. 141–145, fig. 1; 10, pp. 149–163, figs. 5; 11, pp. 175–180*).—A practical summary of information on this important fruit fly, including its geographic distribution, anatomy, development, habits, host fruits, natural enemies, and means of control. A list of 28 references to the literature is included.

The Mediterranean fruit fly is in Florida, W. Newell (*Fla. State Plant Bd. Mo. Bul., 13* (*1929*), *No. 8–10, pp. 121–125*).—This is an announcement of the discovery of the Mediterranean fruit fly in Orange and Seminole Counties,

Fla., on April 6, 1929, where it is known to occur in an area extending approximately 12 miles north and south by 6 miles east and west. A special report of the plant commissioner to the State Plant Board, April 15, 1929, is included.

Observations on the transmission of malaria by anopheline mosquitoes in Ceylon, H. F. CARTER and W. P. JACOCKS (*Ceylon Jour. Sci., Sect. D, Med. Sci., 2 (1929), No. 2, pp. 67–86, pls. 7, figs. 4*).—This is a report of investigations into the natural infection of indigenous anophelines with malaria parasites carried out in villages and on estates in five separate localities situated in highly endemic areas in Ceylon. *Anopheles culicifacies* was the species most commonly examined and was the only one of the nine species dissected which was found infected with malaria parasites.

Zoological contributions to the surra problem.—XXII, Transmission experiments with Anopheles fuliginosus Gil. [trans. title], O. NIESCHULZ (*Centbl. Bakt. [etc.], 1. Abt., Orig., 109 (1928), No. 5–6, pp. 327–330*).—In these studies (E. S. R., 60, p. 850) the author finds that this mosquito can transmit surra mechanically in very short intervals. In experiments with the horse, with 500 specimens, 2 positive cases of transmission resulted.

Zoological contributions to the surra problem.—XXIII, A summary of the results of some surra transmission experiments in Java and Sumatra [trans. title], O. NIESCHULZ (*Arch. Schiffs u. Tropen Hyg., 33 (1929), No. 5, pp. 257–266*).—In summarizing further surra transmission work with insects (see above), the author reports having found tabanids to be the most important, 24 species, including 17 of Tabanus, 3 of Chrysops, and 4 of Haematopota, being capable experimentally of transmitting the trypanosome. Muscids in nature play a quite unimportant part in its transmission, and mosquitoes an even less important part.

A list of 23 references to the literature is included.

Rat-flea survey of the port of Norfolk, Va., H. E. HASSELTINE (*Pub. Health Rpts. [U. S.], 44 (1929), No. 11, pp. 579–589, pl. 1, fig. 1*).—In examinations made of 1,561 rats in Norfolk, Va., from March 16, 1927, to March 31, 1928, 4,898 fleas were taken, of which 81.6 per cent were *Xenopsylla cheopis*, 17.7 per cent *Ceratophyllus fasciatus*, and 0.6 per cent *Ctenocephalus canis* (or *felis*). Six specimens of *Leptopsylla musculi* and one of *Echidnophaga gallinacea* were also taken.

Rat anemia and Bartonella muris ratti, W. W. FORD and C. P. ELIOT (*Assoc. Amer. Physicians, Trans., 43 (1928), pp. 95–102*).—The authors find that anemia can be produced in young rats and young rabbits with blood from anemic splenectomized rats, and that E. Lauda's theory[1] that the anemia is due to infection is thus confirmed.

Tropisms and sense organs of Lepidoptera, N. E. MCINDOO (*Smithsn. Misc. Collect., 81 (1929), No. 10, pp. 59, figs. 16*).—This is a discussion of the tropisms of lepidopterous insects, particularly the codling moth, together with a review of the literature. A list of 93 references to the literature is included. Tropisms are dealt with under the headings of phototaxis, chemotaxis, geotaxis, and thigmotaxis, and tropic receptors under the headings of photoreceptors, chemoreceptors, audireceptors, thigmoreceptors, georeceptors, and other receptors. Scent-producing organs are briefly considered.

Control of the codling moth in the Pacific Northwest, E. J. NEWCOMER, M. A. YOTHERS, and W. D. WHITCOMB (*U. S. Dept. Agr., Farmers' Bul. 1326, rev. (1929), pp. II+26, pl. 1, figs 18*).—This is a practical summary of information on codling moth control in the Pacific Northwest (E. S. R., 51, p. 159),

---

[1] Klin. Wchnschr., 4 (1925), No. 33, pp. 1587–1591; Arch. Path. Anat. u. Physiol. [Virchow], 258 (1925), No. 3, pp. 529–599.

where losses in some years average as high as 20 per cent of the total crop, and those sustained by individual growers are often more than 50 per cent of their crops. A pictorial diagram of the life cycle is included.

***The seasonal life history of the oriental fruit moth in New Jersey during* 1924, 1925, and 1926,** L. A. Stearns and A. Peterson (*New Jersey Stas. Bul. 455 (1928), pp. 48, figs. 11*).—This report of an investigation of the oriental fruit moth in New Jersey during the years 1924, 1925, and 1926 includes a study of its seasonal life history under insectary and orchard conditions at New Brunswick and in nine other localities. The first part of the work is devoted to its seasonal life history in the insectary at New Brunswick (pp. 7–36) and part 2 to its seasonal life history in the orchard (pp. 37–45). An extended summary of the study is included.

The investigation has shown that four generations each year are of normal occurrence, with the development of an additional generation in the southern two-thirds of the State possible in an advanced season. Under the four-brooded condition, the first and second, the second and third, and the third and fourth broods were found to overlap by 1, 2, and 5 weeks, respectively, with 3 per cent of the second brood, 62 per cent of the third brood, and 100 per cent of the fourth brood wintering. It was found that initial seasonal development—the transformation of the overwintered larvae and the emergence of the spring broods of moths—occurred 3 and 2 weeks earlier, respectively, in extreme southern as compared with extreme northern New Jersey, because of a combination of environmental factors, including altitude, temperature, and proximity to the ocean. The comparative rate of development for intervening localities was determined. Much of the data is presented in tabular form.

An earlier account of studies of the life history of this pest by Stearns in Virginia (E. S. R., 46, p. 659) and studies in New Jersey (E. S. R., 58, p. 758) have been noted.

The pink bollworm [trans. title], H. E. Box (*Estac. Expt. Agr. Tucumán Circ. 17 (1928), pp. 7, figs. 5*).—A brief account of this enemy of cotton in Tucumán.

Studies on chemical changes during the life cycle of the tent caterpillar (Malacosoma americana Fab.)—IV, Glycogen, W. Rudolfs (*Jour. N. Y. Ent. Soc., 37 (1929), No. 1, pp. 17–23, figs. 3*).—In studies conducted at the New Jersey Experiment Stations (E. S. R., 58, p. 258), the author has found that the glycogen content of the eastern tent caterpillar changes during the different phases of its life cycle. The greatest changes take place when the larva is actively feeding, and although the percentage of glycogen decreases in respect to the dry weight the actual amount increases about 13 times. No great changes occur during the transformation of liquid eggs into larvae. During the pupal stage the glycogen disappears rapidly, indicating that it plays an important rôle. Glycogen was found in the leucocytes, muscles, fat glands, and eggs.

A note on the synonymy of a birch leaf miner, S. A. Rohwer (*Ent. Soc. Wash. Proc., 31 (1929), No. 3, pp. 62, 63*).—The author concludes that the birch leaf miner, which has been abundant in the last few years in parts of Maine and of Canada, and was described in 1909 by A. D. MacGillivray[3] as *Phlebatrophia mathesoni* n. g. and sp., is the same as the European form, *Phyllotoma nemorata* (Fallén).

The genus Pityophthorus Eichh. in North America: A revisional study of the Pityophthori, with descriptions of two new genera and seventy-one new species, M. W. Blackman (*N. Y. State Col. Forestry, Syracuse Univ.,*

[3] Canad. Ent., 41 (1909), No. 10, pp. 345–362.

Tech. Pub. 25 (*1928*), *pp. 5–183, figs. 124*).—This is a revision of an important group of bark beetles. The genera Myeloborus and Pityophilus are erected, and 71 species are described as new. A list of the trees serving as hosts to the Pityophthori treated in this paper, of their distribution and host trees, and a bibliography of 40 titles are included.

The Mexican bean beetle, 1927–1928, C. O. Eddy and W. H. Clarke (*South Carolina Sta. Bul. 258* (*1929*), *pp. 42, figs. 17*).—This is a summary of studies conducted in 1927–1928 and includes a discussion of the distribution of the beetle and the outlook, a brief review of its life history and seasonal history illustrated with tables and figures, a description and illustrations of this beetle and of the bean leaf beetle with a comparison of their injury and habits, a review of certain poison control investigations, and recommendations for control. This publication supplements the account of the life history and seasonal history of the Mexican bean beetle reported in Bulletin 236 (E. S. R., 57, p. 167).

In the vicinity of Clemson College, one complete and two partial generations occur every year. Occasionally one or two adults of a fourth generation appear, but they never lay eggs. Each year since the entrance of the beetle into the State in 1921, it has spread eastward about 35 miles, except during the extremely dry summers of 1925 and 1926 when it was checked and even forced to recede back to the line of 1924. This lost area and much more was regained in 1927, the damage of that year being the greatest ever observed. Only a slight increase of infested area occurred in 1928, but the damage was again severe, and the entrance of the pest into the coastal section as a major pest was considered probable. Observations indicate that the activities of the pest in future years will be variable in all three sections of the State.

It is pointed out that while magnesium arsenate is considered the most effective arsenical that can be used for the control of the pest on bean plants in South Carolina, calcium arsenate which is sometimes less effective has given as good results as any arsenical, the brands used giving as little injury as magnesium arsenate. Good results have been obtained by dusting with a mixture of calcium arsenate 1 lb., sulfur 1 lb., and lime hydrate 4 lbs. It is pointed out that pyrethrum soap sprays were found to be effective in controlling the pest.

Cucumber beetles, H. C. Huckett (*New York State Sta. Circ. 113* (*1929*), *pp. 8, figs. 7*).—This is a practical account of the striped and spotted cucumber beetles.

The Japanese beetle in Pennsylvania, T. L. Guyton (*Penn. Dept. Agr. Bul. 473* (*1929*), *pp. 15, figs. 9*).—This is a brief practical summary of information.

Notes on the life history and habits of the blueberry stem borer, Oberea myops Hald., on cultivated blueberries, B. F. Driggers (*Jour. N. Y. Ent. Soc., 37* (*1929*), *No. 1, pp. 67–74, pl. 1*).—This contribution from the New Jersey Experiment Stations is based upon observations made of the life cycle and habits of *O. myops*, found boring in stems and branches of the cultivated blueberry at Whitesbog, N. J., from 1923 to 1927, inclusive. A single parasitic enemy of this beetle, a small undetermined hymenopteran, was observed. A practical control for this pest, one which is generally followed in cultivated plantings, consists in cutting out infested shoots at a point below the egg or larva.

Laboratory breeding of the European corn borer (Pyrausta nubilalis Hubn.), with special reference to equipment and cages, L. J. Briand (*Canad. Ent., 61* (*1929*), *No. 3, pp. 51–54, figs. 5*).—The author gives a description of the pupation and oviposition cages used.

The infectious diseases of the European corn borer (Pyrausta nubilalis Hübn.), I, II [trans. title], S. Métalnikov and V. Chorine (*Ann. Inst.*

Pasteur, *42* (1928), *No. 12, pp. 1635–1660, figs. 7; 43* (1929), *No. 1, pp. 136–151, fig. 1*).—These data have been noted from another source (E. S. R., 60, p. 651).

Corn borer situation, L. CAESAR (*Ontario Dept. Agr., Agr. and Expt. Union Ann. Rpt., 50* (1928), *pp. 39–44*).—This is a discussion of the European corn borer situation in Ontario, where it is said to be brighter and more promising than at any previous time.

Moth borer in Louisiana, T. E. HOLLOWAY and W. E. HALEY (*Sugar* [*New York*], *31* (1929), *No. 3, p. 106*).—An account is given of the method of estimating the loss caused by the sugarcane borer to the Louisiana sugar crop as followed by the U. S. D. A. Bureaus of Entomology and Agricultural Economics.

The sterilization of brood combs infected with American foulbrood, C. H. GILBERT (*Wyoming Sta. Bul. 166* (1929), *pp. 149–171*).—This is a report of experiments conducted with four methods of sterilizing brood combs. After 48 hours of treatment Hutzelman's solution failed in 1 case out of 12 to sterilize completely brood combs infected with American foulbrood, while the soap bath, followed by water-formalin solution, failed in 4 cases out of 12. Water-formalin solution failed in 2 cases out of 8 to sterilize brood combs after 48 hours of treatment and 1 case out of 4 after a 72-hour treatment. Hydrocyanic acid gas failed to sterilize brood combs when exposed to the gas for from 24 to 48 hours. The results obtained in the treatment of brood combs infected with American foulbrood showed that unless the technic of treatment is improved and made more certain, it is not advisable to treat combs infected with this disease in which scales or decayed larval remains are found.

The greenhouse centipede, H. K. RILEY (*Indiana Sta. Bul. 331* (1929), *pp. 14, figs. 6*).—This is an account of the life history and means of control of *Scutigerella immaculata* Newp., which within recent years has become a serious problem in Indiana vegetable greenhouses and in some cases a limiting factor in the production of certain crops. This pest lives in ground beds, and when present in large numbers often causes great damage to lettuce and other crops by feeding on and destroying the root hairs and finer roots.

Control work has shown carbon disulfide fumigation of the soil to be most effective under Indiana conditions. Where steam sterilization equipment and underground steam tiles are available, carbon disulfide should be mixed with steam and injected into the soil under steam pressure at the rate of 1 oz. of carbon disulfide to each square foot of surface. Injections with a pipe and funnel have proved effective in houses not equipped with steam tiles. When possible fumigation should be made in the early fall before the first crop is planted, at a soil temperature above 65° F.

Case of arachnoidism (spider bite), L. F. SCHMAUS (*Jour. Amer. Med. Assoc., 92* (1929), *No. 15, pp. 1265, 1266*).—A report upon a case of poisoning in Kansas caused by the bite of *Loxosceles rufescens* Dufour, a species also found in Texas, Florida, Mexico, Costa Rico, Europe, and Japan.

ANIMAL PRODUCTION

The nutritive value of blood-meal protein for growth, A. R. WINTER (*Ohio Sta. Bul. 436* (1929), *pp. 42, figs. 4*).—In an effort to determine the biological value of blood meal for growth, numerous experiments were undertaken with pigs and rats. The digestibility and metabolism of protein and the factors influencing the digestibility of blood-meal nitrogen were determined with both types of animals. The value of protein supplements for blood meal was also studied.

On the whole it was found that the biological value of blood-meal nitrogen for growth was poor. Limiting factors in the nutritive value of blood meal are palatability and digestibility. The first of these is usually poor, but varies according to the source of the blood and the method of preparation, while the second is decreased when the temperature of processing is increased. Blood meal prepared from swine blood had a higher value for rats than that prepared from cattle or sheep blood; also the blood serum was more valuable than the clot. Blood meal was not toxic when properly prepared for animal feeding.

Casein and corn gluten were found to be the most efficient protein supplements for blood meal of the many products tried. The basic amino acids of blood meal and of casein occurred in approximately the same quantities.

Meat through the microscope, C. R. Moulton (*Chicago: Univ. Chicago Press, 1929, pp. XII+528, figs. 58*).—This treatise presents in a nontechnical manner the applications of chemistry and the biological sciences to some of the problems of the meat-packing industry.

Sixth annual report of the National Live Stock and Meat Board: Fiscal year 1928–29, R. C. Pollock (*Natl. Livestock and Meat Bd. Ann. Rpt., 6 (1929), pp. 108, figs. 82*).—The sixth annual report of the board (E. S. R., 59, p. 662) contains brief accounts of studies on the quality and palatability of meat, the iron of meat in the diet, and meat in the rearing of young. Brief reports are also made of publicity contests and information on meat disseminated during the year.

Cattle feeding: Winter steer feeding, 1925–26, 1926–27, 1927–28, J. H. Skinner and F. G. King (*Indiana Sta. Bul. 330 (1929), pp. 26*).—The results of winter steer feeding experiments (E. S. R., 59, p. 762) for the years 1925–26, 1926–27, and 1927–28 are reported in this publication.

In part 1 a comparison between cottonseed meal and whole soybeans as a supplement to rations for fattening cattle was carried out in 2 tests with 2-year-old steers and 3 tests with calves. The rations compared were the same for both kinds of cattle, consisting of shelled corn, corn silage, clover hay, salt, and either cottonseed meal or whole soybeans. In both trials with the aged cattle the rate of gain, the feed required per unit of gain, and the profit returned per steer were in favor of the lot fed whole soybeans. In 2 of 3 trials with calves, cottonseed meal produced greater gains than whole soybeans, but there was little or no difference in the feed required per unit of gain. The finish attained in both lots was practically the same, and the return per head varied but little. These results indicate that essentially the same results may be expected from whole soybeans and cottonseed meal.

The value of cottonseed meal for fattening cattle when added to a ration of shelled corn, soybean hay, and corn silage for 2-year-old steers is reported in part 2. The cattle receiving cottonseed meal made greater gains than those receiving no supplement, but the gains were not as economical. The finish attained was practically the same in both lots, and the profit per head greater in the lot where no supplement was fed.

In part 3 the value of soybean hay for fattening cattle was determined. In this study 3 lots of 2-year-old steers were fed a ration of shelled corn, cottonseed meal, and salt. Lots 1 and 3 also received corn silage, lot 1 clover hay, and lots 2 and 3 soybean hay. It was found that soybean hay and silage produced faster gains and a higher finish and returned a greater profit than clover hay and silage. Soybean hay fed as the sole roughage was satisfactory but not as profitable as when fed with silage.

Oats and cottonseed meal were compared in 2 tests reported in part 4 as supplements to a ration of corn, clover hay, and corn silage for 2-year-old

steers. Three lots of cattle were fed in each trial, lot 1 receiving cottonseed meal, lot 2 whole oats, and lot 3 ground oats. Cattle fed cottonseed meal made greater gains, had a better finish, and returned more profit per head than those fed oats in spite of the fact that the oat-fed cattle made more economical gains. Ground oats produced larger and more economical gains and a better finish and returned a larger profit than whole oats, but the cattle fed ground oats shrank more in shipping than those fed whole oats.

In part 5 the value of ground oats as a partial substitute for corn was determined in 1 trial with 2-year-olds and 2 trials with calves. The check lot in each case received shelled corn, cottonseed meal, corn silage, clover hay, and salt. Ground oats replaced approximately one-third of the shelled corn in the test lots. For the aged steers substituting ground oats for part of the corn increased the rate of gain slightly, produced a higher finish, and returned a slightly greater profit. On the average, adding ground oats to the ration of calves had a depressing effect on gains, decreased the economy of gain, and reduced the profit per head.

Returns per acre in cattle feeding, Madison County Experiment Farm, P. Gerlaugh and H. W. Rogers (*Ohio Sta. Bimo. Bul. 139 (1929), pp. 126–129, figs. 3*).—Yearling steers averaging approximately 615 lbs. per head were divided into two lots of 14 and 10 head, respectively. The first lot was fed corn silage from an area of 6.5 acres, while for the second lot a similar area was shocked and later husked and cribbed. The corn stover from this area was also fed to the latter lot. Cottonseed meal at the rate of 2 lbs. per head daily and mixed hay were fed in both lots. The husked corn yielded 312 bu. from the 6.5 acres.

After 110 days of feeding, the husked corn was all consumed. Up to this time the grain-fed calves had made an average daily gain of 2.39 lbs. per head, while the silage-fed calves had gained 2.2 lbs. per head daily. The appraised value of the grain-fed calves was 75 cts. per hundredweight higher than that of the silage-fed calves at this date. The grain-fed calves were continued on the same ration until the supply of silage fed in the other lot was depleted.

Enough silage was produced on the 6.5 acres to feed lot 1 for 174 days. For the entire period average daily gains of 2.01 and 2.24 lbs. per head were made in the respective lots. It was calculated that an acre of corn fed as silage produced 791 lbs. of gain on cattle and the pigs following, while when fed as shelled corn and stover it produced only 439 lbs. of gain. The difference in the appraised value of the two lots was the same at the end of 174 days as at the end of 110 days. When slaughtered lot 1 dressed 59.6 per cent and lot 2 60.6 per cent, and the latter carcasses showed a little more covering of fat.

Based on the results obtained, an acre of corn in this study fed as silage returned $71.65, while a similar acre fed as shelled corn and stover returned only $50.80.

Substitutes for fish meal in the rations of fattening pigs, edited by H. R. Davidson (*Jour. Min. Agr. [Gt. Brit.], 35 (1928), No. 5, pp. 409–422*).—A series of experiments carried out under the direction of the Animal Nutrition Research Institute, Cambridge, England, the Rowett Research Institute, and the Harper Adams Agricultural College were made to determine the value of fish meal as a supplement to a basal ration of cereals for feeding pigs. The experiments naturally divided themselves into three groups, namely, the value of the mineral fractions, the value of several vegetable and animal proteins in conjunction with the necessary minerals, and successful substitutes for fish meal.

The value of fish meal was found to be associated with the protein content and particularly with the amount and proportions of the mineral constituents.

The oil of fish meal did not have any particular value for growth but exerted a slightly depressing effect on gains. Vegetable proteins properly supplemented with minerals gave as good results as fish meal, but neither supplement produced high-grade carcasses. Of the vegetable supplements used, extracted soybean meal was the most valuable. Observations of the carcasses of the animals used in these experiments indicated that the quality of fat and the shape of carcass were not always best in the fastest gaining animals.

Fifty per cent pineapple bran mixture for fattening hogs, L. A. Henke, N. K. Pekelo, and J. S. Low (*Hawaii Univ. Quart. Bul., 7 (1928), No. 1, pp. 13, 14*).—In a test at the University of Hawaii, 4 crossbred pigs fed a ration of pineapple bran 50 lbs., wheat middlings 30, coconut meal 10, tankage 10, salt 1, and raw rock phosphate 1 lb., supplemented with 1 lb. of green alfalfa per pig daily, made average daily gains of 1.02 lbs. per head during a 100-day feeding period. For each pound of gain 5.45 lbs. of grain mixture were required.

Comparative value of pineapple bran, cane molasses, and barley as feeds for fattening hogs, L. A. Henke (*Hawaii Univ. Quart. Bul., 7 (1928), No. 1, pp. 15–17*).—Average daily gains of 0.82, 0.62, and 1.11 lbs. per head were obtained in 3 lots of 6 pigs each on rations containing 50 per cent of pineapple bran and 30 per cent of wheat middlings, 40 per cent of pineapple bran and 25 per cent of cane molasses, and 90 per cent of barley, respectively, all properly supplemented, in a study at the University of Hawaii. For each pound of gain it required 5.47, 7.06, and 4.25 lbs. of concentrates in the respective lots.

The influence of ultra-violet rays and vitamin D on the growth of fall farrowed pigs, R. D. Sinclair (*Sci. Agr., 9 (1929), No. 10, pp. 629–648, figs. 8*).—The effect of winter sunlight and of cod-liver oil on the growth of fall pigs was determined in two experiments at the University of Alberta. In the first test 3 lots and in the second test 4 lots of pigs were fed the same basal ration. One lot in each test was confined indoors without any sunlight, 1 was allowed access to an open yard at all times, and 1 was confined indoors the first half of the test and then allowed access to an open yard for the second half. In the second experiment the fourth lot was confined indoors but was fed cod-liver oil at the rate of 0.5 lb. per 100 lbs. of grain mixture. Analyses were made of bone and blood calcium and phosphorus.

It was found that exposing fall pigs to sunlight increased the rate and economy of gains. The pigs confined during the first half of the test did not develop any stiffness such as occurred in the lots deprived of sunlight, but a study of their weights indicated a more efficient use of their feed after being exposed to sunlight. Adding cod-liver oil to the ration of confined pigs increased the rate and economy of gains as compared with the lots receiving sunlight.

Exposure to sunlight and feeding cod-liver oil resulted in an increase in the percentage of bone ash and an increase in the percentage of calcium in the bone. The ash determinations of the blood samples were unsatisfactory due to the small number of animals used. Calcium and phosphorus were present in the bone in the ratio of 2 : 1 and in the feed in the ratio of 1.7 : 1.

The way of a man with a horse, G. Brooke (*Philadelphia: J. B. Lippincott Co. 1929, pp. 288, pls. [62, fig. 1]*).—A practical treatise designed as a guide for beginners covering such points as stabling, feeding, care of horses, and equipment, together with suggestions and advice on the way to run the stable and to ride and train horses. The section of the treatise on The Prevention of Disease and the Treatment of the Minor Ailments of Horses (pp. 102–161) was prepared by A. C. Todd, while A. Brooke contributed the chapter on Pig-Sticking (pp. 266–281).

Practical poultry keeping, T. F. McGrew (*New York: Thomas Nelson & Sons, 1928, pp. VI+214, figs. 62*).—A practical treatise on the breeding, feeding, and management of poultry.

Keeping chickens in confinement, D. C. Kennard and R. M. Bethke (*Ohio Sta. Bul. 437 (1929), pp. 22, figs. 9*).—In this publication the authors discuss the advantages and disadvantages, the present methods in use, the necessity for proper feeding, and a practical plan for confining poultry.

The feeding of poultry, G. S. Robertson and R. G. Baskett (*Jour. Min. Agr. North. Ireland, 2 (1929), pp. 1–13, pls. 2*).—The results of two experiments to obtain information on the influence of certain nutritional factors on egg production are reported in this paper. White Wyandotte pullets of the same breeding and age and reared under the same conditions were divided into 4 groups of 8 head each, housed under the same conditions, and fed for 2 years. Group 1 received a basal ration of pollard, bran, maize meal, and ground oats, 2 : 1 : 1 : 1. In group 2 the basal ration was supplemented with 2.2 per cent of a mineral mixture, in group 3 with 13.5 per cent of extracted soybean meal and 1.7 per cent of mineral mixture, and in group 4 with 10 per cent of fish meal. The same scratch feed was given to all lots, and all had free access to oyster shells.

Adding minerals to the basal ration produced an average increase in egg production for the two experiments of 20.5 per cent as compared with the group receiving no minerals. The further addition of a protein-rich feed resulted in an additional increase of 13.5 per cent in egg production. The results gave no evidence that fish meal was any more valuable than extracted soybean meal provided the soybean meal was supplemented with minerals. The addition of minerals also increased the weight of the eggs produced, improved the condition of the birds, and resulted in a better utilization of the mash.

The value of milk and meat proteins in chick rations, O. N. Massengale (*Poultry Sci., 8 (1929), No. 3, pp. 151–158, fig. 1*).—The same basal ration was fed to 10 lots of 20 to 29 5-day-old chicks each for a period of 7 weeks at the New Jersey Experiment Stations. In addition to the basal ration the following supplements were fed: Lot 1 fresh skim milk to drink; lot 2 liquid semisolid buttermilk; lot 3 liquid buttermilk powder; lots 4, 5, 6, 7, and 8 100 parts of basal ration plus 10 parts of milk powder, 15 parts of milk powder, 8 parts of meat scrap, 12 parts of meat scrap, and 15 parts of meat scrap, respectively; lot 9 same as lot 7 with liquid semisolid buttermilk; and lot 10 same as lot 8 with liquid semisolid buttermilk.

The lots receiving meat scrap supplement without milk showed a pronounced nutritional disturbance during the third to sixth week. This was especially true in the lot receiving 15 per cent of meat scrap, where the symptoms manifested were similar to a vitamin B deficiency. Two chicks in this lot fed yeast at the onset of the disorder became apparently normal in 3 days. The combs and shanks of the chicks fed meat scrap with or without milk were pale, while the milk-fed chicks showed better color.

These results led to the conclusion that for chicks up to 8 weeks of age it is not advisable to feed a ration containing a high percentage of meat scrap, and that when meat scrap is used some form of milk should be included in the ration.

Nutritional leg-weakness in poultry, R. J. Miller, R. A. Dutcher, and H. C. Knandel (*Poultry Sci., 8 (1929), No. 3, pp. 113–123, figs. 4*).—Two studies of this nutritional disturbance were undertaken at the Pennsylvania Experiment Station, using 4 lots of 100 day-old Leghorn chicks per group in each test. Line

tests and bone-ash determinations were made on the tibiae of 6 chicks at the end of each week.

In the first study a rickets-producing ration was fed to each lot, supplemented in lot 2 with sunlight transmitted through Cel-O-Glass, in lot 3 by ultra-violet light from a quartz mercury vapor lamp for 15 minutes daily at a distance of 30 in., and in lot 4 by 2 lbs. of Newfoundland cod-liver oil per 100 lbs. of the basal ration. In the second study the first lot received a ration known as Pennsylvania State College all-mash ration, lot 2 received the rickets-producing ration supplemented by sunlight transmitted through Vitaglass, lot 3 ultra-violet light from a blue-flame carbon arc lamp for 15 minutes daily at a distance of 40 in., and lot 4 2 lbs. of Norwegian cod-liver oil per 100 lbs. of the basal ration.

In study 1 the basal ration group did not grow as well from the fourth to the eighth week as did the other groups. Groups 2 and 3 grew at the same rate, which was somewhat superior to the growth in group 4. All leg weakness was confined to group 1. The ash determinations showed that the Cel-O-Glass group had the best bone-depositing ability, followed in order by the cod-liver oil and ultra-violet light groups. In study 2 the group receiving the all-mash ration grew at a rapid rate as compared with the other groups, and the ability to deposit calcium and phosphorus in the bone was greatest in this lot.

This study shows that irradiation by the two lamps used and transmission of sunlight through the substitutes used produced results in growth and skeletal development equal to those obtained with Newfoundland and Norwegian cod-liver oils.

A study of fertility in poultry, V. Curtis and W. V. Lambert (*Poultry Sci., 8 (1929), No. 3, pp. 142–150*).—White Leghorn, White Plymouth Rock, and Rhode Island Red hens were confined in a building kept as near 70° F. as possible throughout this study at the Iowa Experiment Station. Stud mating was practiced with males of the same breeds, but one phase of the study dealt with crossbreeding, particularly with reference to selective fertilization. Eggs were collected four times daily and placed in incubators twice weekly. After 80 hours of incubation, the eggs were candled and the condition of fertility of each egg was noted.

In 19 of 35 successful single matings the first fertile egg was laid between 36 and 48 hours, in 13 matings between 60 and 72 hours, and in 3 matings after 84 hours. The average onset of fertility was found to be 57.1 ± 2.6 hours after mating. From a single mating fertility was found to endure from 4 to 21 days, with an average of 10.7 ± 0.4 days. A single mating produced an average of 5.5 ± 0.3 fertile eggs, with a range of from 2 to 11.

Only 4 of the 21 double matings produced usable data. The mean number of chicks sired per male in these matings was 3 ± 0.5 for the Rhode Island Reds and 4.3 ± 0.8 for the White Plymouth Rocks. While these results were not conclusive, they do indicate some selective fertilization. Matings made between birds of different ages showed that hens had a longer period of fertility than pullets, and that cockerels produced a greater number of fertile eggs than cocks.

Observations concerning the time factor in egg production, H. Atwood (*Poultry Sci., 8 (1929), No. 3, pp. 137–140*).—At the West Virginia Experiment Station (E. S. R., 57, p. 369), 172 White Leghorns in their first laying year were trapped hourly beginning at 8 a. m., and ending at 5 p. m. during the month of August. One year later the same birds were again trapped in a like manner.

An examination of the data obtained showed that the longer the cycle of egg production the shorter was the interval between the laying of successive

eggs. The intervals between the laying of eggs at the middle of a cycle were shorter than the intervals at either the beginning or the end, and usually the interval between the last two eggs was greater than at any time during the cycle. The more prolific layers usually had the shorter intervals between eggs. The intervals between successive eggs were longer as the birds became older.

Culling and selecting for egg production, G. O. Hall, D. R. Marble, and J. E. Rice (*N. Y. Agr. Col. (Cornell) Ext. Bul. 175 (1928), pp. 41, pls. 4, figs. 30*).—A popular publication explaining and illustrating in a very concise manner the methods of culling and selecting birds for egg production.

A study of the relationship between body size of mature pullets and the size of eggs laid by them, J. G. Rhynehart (*Jour. Min. Agr. North. Ireland, 2 (1929), pp. 97–102*).—An analysis of the records of the White Wyandotte and White Leghorn pullets in the six laying tests conducted by the Ministry of Agriculture of Northern Ireland showed with remarkable uniformity that the average proportion of second-grade eggs was highest in the case of the lighter weight birds, and also that the average total production of the heavier birds was equally as good as that of the lighter birds. These results led to the recommendation that for best results breeders should select pullets that weigh at the time laying starts 5 lbs. in the case of White Wyandottes and 4 lbs. in the case of White Leghorns.

The effect of early hatching on profits from poultry and on the size of egg, J. G. Rhynehart (*Jour. Min. Agr. North. Ireland, 2 (1929), pp. 88–96*).—Two tests were conducted at the Ulster Dairy School, Cookstown, Northern Ireland, to determine the value of early hatching. One lot of March-hatched and one lot of May-hatched pullets were compared in each test. The number of eggs laid and the size of each egg were recorded. Both studies were started October 1 and continued to May 1.

The early hatched pullets in both studies began laying about two months earlier than the May-hatched pullets. In the first study 29.7 per cent and in the second study 19 per cent of the eggs laid by the March-hatched pullets weighed less than 2 oz., while for the May-hatched the corresponding figures were 62.9 and 26.4 per cent, respectively. The value of the eggs produced by the early hatched pullets was greater, since they laid more eggs during the period of high prices.

Research work in turkey raising, M. A. Jull (*Poultry Sci., 8 (1929), No. 3, pp. 129–132*).—In this paper from the U. S. D. A. Bureau of Animal Industry, the author has listed the State experiment stations and the Canadian provincial institutions conducting research work with turkeys and the nature of the work at each place.

Experimental Fox Ranch, Summerside, P. E. I.: Report of the superintendent, G. E. Smith (*Canada Expt. Farms, Expt. Fox Ranch, Summerside (P. E. I.), Rpt. Supt. 1926–1927, pp. 59, figs. 15*).—A report of the investigations in nutritional problems relating to raising silver foxes in captivity as carried out at the Dominion Experimental Fox Ranch, Summerside, P. E. I. In addition the equipment and the methods of managing the foxes are explained.

DAIRY FARMING—DAIRYING

Dairy work at the Huntley Field Station, Huntley, Mont., 1918–1927, T. W. Moseley, D. Stuart, and R. R. Graves (*U. S. Dept. Agr., Tech. Bul. 116 (1929), pp. 48, figs. 14*).—The work reported in this publication is a summary of tests that have been conducted from 1918 to 1927.

Pasture experiments.—Continuing these studies (E. S. R., 55, p. 169), it was found that the average length of grazing season for an acre of irrigated grass pasture over a period of 9 years was 138 days and an averge of 2.22 cows per acre were carried during this period. An average gain in weight of 43.2 lbs. per cow was produced while on pasture. The average production per acre per pasture season was 7,041 lbs. of milk, containing 268.7 lbs. of butterfat.

An acre of irrigated sweetclover furnished 1.57 cows with 111 days of grazing during 1927. The cows lost an average of 68.9 lbs. in weight during the grazing season. During the period on pasture they produced 4,942.3 lbs. of milk and 197.8 lbs. of butterfat.

Over a 6-year period an acre of irrigated grass pasture top-dressed with manure had an average carrying capacity of 1.8 cows for a grazing period of 135.1 days, while a similar acre not top-dressed furnished pasture for 1.43 cows over the same period. The cows on the top-dressed pasture gained an average of 37 lbs. in weight and produced 3,568 lbs. of milk, containing 132.9 lbs. of butterfat. The untreated pasture produced an average gain of 12 lbs. in weight and the cows produced 2,883 lbs. of milk and 104.2 lbs. of butterfat.

During the 1927 grazing season it was observed that cows on pasture alone grazed an average of 9.16 hours per day, those receiving alfalfa hay in addition to the pasture 6.51 hours, those on a limited grain ration 5.6 hours, and those on a full grain ration 5.33 hours per day.

In a study of the effect of pasture on the breeding efficiency of dairy cows, the year was divided into 3 periods, namely, pasture season about 4.5 months, the 2 months following pasture, and the remainder of the year. Results showed that the average number of cows that conceived on first service was practically the same during the various seasons. However, there were indications that for cows requiring 3 or more services per conception pasture did have a beneficial effect.

Feeding experiments.—Continuing the study of the effect of 3 planes of feeding on milk production (E. S. R., 54, p. 167), 10 cows were fed on rations of roughages alone, consisting of alfalfa hay, corn silage, roots, and irrigated grass pasture; on the same roughage with 1 lb. of grain mixture for each 6 lbs. of milk produced; or on the same roughage with 1 lb. of grain for each 3 lbs. of milk. While on roughage alone the cows produced an average of 13,656.5 lbs. of milk and 478 lbs. of butterfat, on a limited grain ration 16,648.6 lbs. of milk and 584.1 lbs. of butterfat, and on a full grain ration 17,851.5 lbs. of milk and 619.9 lbs. of butterfat. These production records were the averages calculated to maturity. The average return over feed cost was highest in the lot receiving the limited grain ration, followed in order by the roughage alone and full grain ration lots.

Using the double reversal method, 2 lots of 4 cows each were fed through 3 periods of 40 days each. Alfalfa hay was fed at the rate of 2 lbs. per 100 lbs. of live weight and as much sunflower silage as they would consume during 1 period and corn silage during the next. While receiving sunflower silage the cows lost on the average 73.4 lbs. and produced 1,635.4 lbs. of milk and 60.9 lbs. of butterfat. On corn silage the cows gained an average of 31 lbs. and produced 2,187.8 lbs. of milk, containing 75.06 lbs. of butterfat. The cows consumed 1,205.4 lbs. more corn silage than sunflower silage, but when on the former feed ate 10 lbs. less hay.

Following the feeding of sprouted oats, 3 heifers conceived at the first service which had been previously bred from 4 to 9 times without success. The same was true of 2 cows that had been bred either 2 or 3 times previous to the feeding of sprouted oats. In all but one case conception occurred in less than a month after the feeding of sprouted oats was started.

Factors influencing variation in weight of dairy cows and calves.—The total average increase in the weight of 53 cows from the date of service to the date of calving was 285 lbs., of which 130 lbs. were due to an increase in body weight. The average weight of the calves born was 97 lbs., and the average weight of the placenta and amniotic fluid was 58 lbs.

In a study of weight for the 3 months following calving, 59 cows were weighed 2 days each week for 13 weeks. It was found that cows lost weight until the end of the fifth week after calving, after which there was little change in body weight. The heaviest losses occurred the first week following calving.

Seventy-nine cows were sorted into 5 groups, and a study was made of their weight changes previous to and immediately following calving. It was found that from the tenth to the first day before calving there was a fairly uniform increase in weight in all age classes, the average being 16 lbs. A more uniform decrease in weight from the first to the seventh day after calving was found, the average loss being about 40 lbs. No relationship was found to exist between the loss in weight of the dam or the size of the calves at birth and the age of the dams. The average birth weight of the calves in the various groups was quite uniform.

The average birth weight of 47 heifers was 90.2 lbs. and of 42 bulls 97.8 lbs. A gradual increase in the size of both heifer and bull calves at birth was found as the dams increased in weight up to 1,500 lbs.

The average weights of Holstein-Friesian heifers by months from birth to 2 years of age are given in tabular form and compared to the weights of similar animals grown at Ardmore, S. Dak., and Beltsville, Md., and with heifers grown at the Missouri Experiment Station.

Breeding experiments.—This work is carried on in an effort to build up a herd that will be homozygous for the inheritance of high milk and butterfat production. All the bulls born in this herd are proved, and those exceptionally prepotent for high production were used in this and other breeding experiments.

The art of milking, A. C. AGGARWALA (*Punjab Dept. Agr., Vet. Bul. 20* (*1928*), *pp. 2+15, pls. 16*).—In this publication the author describes and illustrates the correct method of milking in order to obtain a sanitary product without injury to the cows.

An investigation of the milk yield of dairy cows, J. F. TOCHER (*Biometrika, 20B* (*1928*), *No. 2, pp. 105–244, pls. 2, figs. 81*).—In this study analyses of all the records of the Scottish Milk Records Association were made for the years 1911, 1912, and 1920 and of portions of the records for the years 1908, 1909, and 1923. The factors studied were yield of milk and average percentage of butterfat during a lactation period, age of cow, length of lactation period in weeks, and total yield of butterfat during a lactation period.

It was found that the relationships between quantity and average percentage of butterfat and between percentage of butterfat and average quantity are practically linear. Cows producing heavily during a lactation period are less variable among themselves with regard to butterfat than cows with low yields. Also cows having high average percentages of butterfat are less variable in regard to average quantity than cows with low percentages of butterfat. There was a constant increase in total yield for a lactation period up to about 13 years, after which there was a decrease with age. A gradual fall was found in the average percentage of butterfat with increasing age up to about 11 years, after which there was an average increase with age. The maximum amount of butterfat was produced between the ages of 10 and 11 years. The average yield of milk per week was practically constant after the cows had been in milk for 26 weeks, and the mean yield per week varied from 16.88 gal. in the case of

3-year-old cows to 19.96 gal. in the case of 8-year-old cows, gradually falling to 19.13 gal. for 12-year-old and older cows. The variability of yield per week increased from 3.1 gal. at 3 years old to 3.6 gal. at 12 years old.

The highest correlation of any two of the factors was found between quantity and length of lactation period, the mean value being about 0.6. The regression of average percentage of butterfat on weeks in milk is nonlinear, but does not vary greatly from linearity. Those cows with long lactation periods give on the average higher average percentages of butterfat during a lactation period than cows with short lactation periods.

Cows calving during the months of August, September, October, and November have significantly longer lactation periods than cows calving during other months. The percentage of butterfat and the yield of fat and milk per week were approximately the same for all months.

Variations in the composition of milk ([*Gt. Brit.*] *Min. Agr. and Fisheries Misc. Pub. 65* (*1929*), *pp. 19, pls. 3, figs. 2*).—A summary of the factors known to influence the variations in the composition of milk.

A study of churn sanitation, N. JAMES (*Sci. Agr., 9* (*1929*), *No. 10, pp. 649–655*).—The Manitoba Agricultural College undertook this study to determine the significance of a presumably clean churn as a source of contamination to butter and how this source of contamination could be overcome. A series of three experiments was conducted, using two churns which were cleaned in what is recognized as the proper manner. The contamination was determined by introducing 12 gal. of sterile water, running the churn in high gear with the workers in motion for 10 minutes, removing the water to sterile containers, and making mold and yeast counts.

It was found that even after churns were celaned in the usual manner, molds and yeasts were discharged in sterile water. When a sterilizing medium was used in the churn, filling two-thirds full rendered it more nearly sterile than filling one-third full. When water heated to near boiling was used for sterilizing, it was removed from the churn free from molds and yeast. However, molds and yeasts were worked from the churns even after exposure to hot water and chemicals, which indicates that these sterilizing agents do not come in contact with the contamination. The results of the study led to the recommendation that in order to minimize the germ content of a churn it should be filled to above the rolls and worked during the sterilizing operation.

The microbiology of cheese from pasteurized milk [trans. title], S. B. PANFILOV (PANPHILOFF) (*Trudy Vologodsk. Moloch. Khoz. Inst.* (*Arb. Milchw. Inst. Wologda*) *Biul. 68* (*1928*), *pp. 21–43, fig. 1*).—In a study of the effect of pasteurization of milk on the microflora of cheese, batches of milk at the Vologda Dairy Institute, Union of Socialistic Soviet Republics, were subjected to temperatures of 70° C. for 20 minutes, 65° for 30 minutes, and 63° for 50 minutes. The last two temperatures showed the lowest number of organisms after pasteurizing, but at these temperatures a greater percentage of the lactic acid organisms, especially *Bacterium casei*, remained than at the highest temperature. The cheese made from milk pasteurized at 70° showed a maximum number of organisms on the seventh day, while the maximum was not reached until the end of a month in the cheeses made from milk pasteurized at 65 or 63°. The pasteurizing temperature had a marked effect upon the speed of ripening. Due to the fact that the greater number of *B. casei* remained at the lower temperatures, the cheeses made from milk pasteurized at 65 and 63° ripened after 4 months, since these organisms were able to overcome the *Streptococcus lactis* introduced as a starter.

Bacteriological analyses of the ripening of Romadur cheese [trans. title], V. I. VERESHCHAGINA (W. J. WERESTSCHIAGINA) (*Trudy Vologodsk. Moloch.*

Khoz. Inst. (*Arb. Milchw. Inst. Wologda*) *Bul. 67* (*1928*), *pp. 5–20, fig. 1*).—After describing the methods of manufacture and the chemical composition of Romadur cheese, this paper gives the results of a study of the bacteriological changes during the ripening of the cheese.

It was found that during the heating process the number of bacteria increased rapidly, and that for several days thereafter the number gradually increased but later decreased until the end of the ripening period. The particles of cheese contained more bacteria than did the whey. The development of the microflora was uniform throughout the entire cheese. The lactic acid group of organisms predominated during the entire ripening process, *Streptococcus lactis* being most numerous in the early stages and *Bacterium casei* later predominating. The gelatin liquefying types were not numerous, fluctuating within the limits of 1 per cent.

VETERINARY MEDICINE

Diseases common to man and animals, R. Randall (*Mil. Surg., 64* (*1929*), *No. 6, pp. 882–893*).—A practical summary of information on the diseases common to man and animals.

On bovine piroplasmosis in Hokkaido (Japan) [trans. title], K. Ogura (*Jour. Japan. Soc. Vet. Sci., 8* (*1929*), *No. 1, pp. 1–38, pls. 4; Japan. abs., pp. 37, 38*).—An extended report of studies conducted in connection with a review of the literature, a list of 50 references to which is included. The author finds piroplasmosis of cattle in Hokkaido to be due to two forms of Piroplasma, the larger resembling *P. bigeminum* and the smaller *P. mutans*.

Rinderpest: Active immunization by means of the serum simultaneous method; goat virus, J. T. Edwards (*Agr. Jour. India, 23* (*1928*), *No. 3, pp. 185–189*).—The author reports that it has become possible to fix the rinderpest virus upon goats and to passage it successfully in these animals by injection of the healthy goat with small quantities of blood from the affected goat. The advantages of using virus from the goats in immunizing cattle are pointed out, and the procedure is described.

Negative results obtained on introducing heat-killed cultures of Salmonella aertrycke and Salmonella enteritidis into the intestinal tract of monkeys and other animals, G. M. Dack, P. H. Harmon, and I. E. Jarra (*Jour. Prev. Med., 2* (*1928*), *No. 6, pp. 461–478*).—Experiments conducted with monkeys, rabbits, dogs, and cats fed with heat-killed cultures of *S. aertrycke* failed to show the characteristic gastrointestinal disturbances present in man in paratyphoid intoxication.

Unsuccessful attempt to produce Salmonella intoxication in man, G. M. Dack, W. E. Cary, and P. H. Harmon (*Jour. Prev. Med., 2* (*1928*), *No. 6, pp. 479–483*).—The authors found that heat-killed dextrose broth beef heart cultures and filtrates of five strains of *S. aertrycke* and four strains of *S. enteritidis*, when fed in large amounts to 24 adults on an empty stomach, failed to produce any symptoms, although the same materials produce symptoms and death when injected intravenously into rabbits in 0.5 to 2 cc. amounts. No agglutinins for homologous strains were present in the serums of these subjects 10 days after feeding.

The position of para-abortus and para-melitensis strains in the genus Brucella, I. F. Huddleson and M. Johnson (*Jour. Amer. Vet. Med. Assoc., 74* (*1929*), *No. 6, pp. 940, 941*).—The authors report having succeeded in producing para strains from many strains of *B. abortus* (Bang) and *B. suis* (Traum).

The significance of Brucella abortus agglutinins in human serum, C. M. Carpenter, R. Boak, and O. D. Chapman (*Jour. Immunol., 17* (*1929*), *No. 1,*

pp. 65–83, figs. 3).—In agglutination tests for evidence of *B. abortus* infection on the serum collected from 4,050 samples in Syracuse, N. Y., 7.3 per cent were found to contain abortus agglutinins. An examination of 955 similar samples collected in New York City showed 2.4 per cent to agglutinate a *B. abortus* antigen.

"*B. abortus* agglutinins could not be demonstrated in the serum from adults who had been drinking pasteurized milk containing such antibodies. Evidence is submitted to indicate that *B. abortus* agglutinins in the blood serum are a result of an active production by the living organism which has invaded the tissues of the body. *B. abortus* agglutinins may disappear from human serums very slowly. One serum titer was 1:405 two years after apparent recovery from undulant fever. Because of the variable antigenic properties of certain strains of *B. abortus*, no specific serum titer can be established as diagnostic of undulant fever."

Undulant (Malta) fever: Isolation of the Brucella organism from the stools, H. L. AMOSS and M. A. POSTON (*Jour. Amer. Med. Assoc., 93 (1929), No. 3, pp. 170, 171*).—By a method described for the isolation of the organism from human feces by agglutination and planting, a Brucella strain has been cultivated 36 times from the stools of a patient suffering from Brucella peritonitis and oophoritis. *B. abortus* of the porcine variety was isolated from the stools of another patient in the sixteenth month of his infection. It is pointed out that Brucella organisms have not hitherto been cultivated from human feces intra vitam.

Undulant fever symposium (*New York: Amer. Pub. Health Assoc., 1929, pp. V+40, figs. 2*).—The following papers were presented at a symposium of the laboratory section of the American Public Health Association, held in October, 1928: *Brucella abortus* in Milk and Its Relation to Undulant Fever, by C. M. Carpenter and M. J. King (pp. 1-11); Further observations on Human Infection with *Brucella abortus*, by J. G. McAlpine and F. L. Mickle (pp. 12–17) (E. S. R., 59, p. 579); The Differentiation of the Species of the Genus Brucella, by I. F. Huddleson (pp. 18–24); A Study of Methods for the Isolation of *Bacterium abortus*, by R. Gilbert, M. B. Coleman, and W. M. Groesbeck (pp. 25–28); Some Unsolved Undulant Fever Problems, by A. C. Evans (pp. 29–33); A Further Epidemiological Study of Undulant Fever in Michigan, by P. F. Orr and I. F. Huddleson (pp. 34–38) (E. S. R., 58, p. 675); and Epidemiological Studies of Undulant Fever in Iowa, by A. V. Hardy (pp. 39, 40).

Results from the use of Huddleson's vaccine for Bang's disease, W. GILTNER, I. F. HUDDLESON, L. T. CLARK, and A. S. SCHLINGMAN (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 6, pp. 885–891*).—It was found that the injection of the living nonvirulent strain of *Brucella abortus* in the form of a vaccine into cattle, both pregnant and nonpregnant, produces no harmful results. The injection of the vaccine into negative animals in two of the series of field tests brought about a striking reduction in the abortion rate in these animals over a period of from 1 to 3 years. In the other series in which negative controls were maintained there was not a wide difference in the abortion rate between the treated and control animals.

It was conclusively determined that experiment animals can be protected against massive artificial infection over a period of 2 years. The vaccine must still be considered in the experimental stage, and further well-controlled tests should be made to determine its value as an agent for protecting cattle against *B. abortus* infection. These data emphasize the fact that the efficiency of an immunizing agent against Bang's abortion disease should be determined on the basis of the presence or absence of infection, rather than on the presence

or absence of the most conspicuous symptom of the disease in the treated animals.

Correlation of the rapid and the slow agglutination tests for Bang's abortion disease of cattle, C. C. PALMER and H. R. BAKER (*Jour. Amer. Vet. Med. Assoc., 75 (1929), No. 1, pp. 86–90*).—It is concluded from the experiments conducted at the Delaware Experiment Station that the rapid agglutination test is as accurate as the slow agglutination test for the serum diagnosis of Bang's abortion disease.

The morphological study of the virus of bovine contagious pleuropneumonia, H. FUTAMURA (*Jour. Japan. Soc. Vet. Sci., 8 (1929), No. 1, pp. 39–50, pls. 2; Japan. abs., pp. 48–50*).—The author finds that the development of this organism follows definite phases, so that its forms can be distinguished from one another according to the age of the culture. The form of the virus changes successively from spherical to filiform, vibrio, purely monococcoid and coccobacillary, and finally again to spherical, although there may be some transitory forms.

A list is given of 15 references to the literature.

Johnin versus avian tuberculin as a diagnostic agent for paratuberculosis (Johne's disease) of cattle, W. A. HAGAN and A. ZEISSIG (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 7, pp. 985–1003*).—The authors' experience with avian tuberculin as a diagnostic agent for Johne's disease led to the conclusion that when injected intravenously this tuberculin induces in cattle which are affected with the disease a temperature reaction which is indistinguishable from that induced by johnin. The reaction is a sharp upward curve which generally reaches its climax about the fifth or six hour after injection, after which it quickly subsides. In some animals the climax may appear somewhat earlier, the second or third hour, or considerably later, the twelfth hour.

A note on the use of mustard in the treatment of sheep for parasites, W. H. WRIGHT (*Jour. Amer. Vet. Med. Assoc., 75 (1929), No. 1, pp. 100–103*).—In the experiments conducted, mustard alone has been ineffective against stomach worms (*Haemonchus contortus*) and hookworms (*Monodontus trigonocephalus*) of sheep. In one test a 1 per cent solution of copper sulfate and mustard removed a small percentage of the nodular worms present.

The position with regard to liver fluke in South Wales, H. W. THOMPSON (*Welsh Jour. Agr., 5 (1929), pp. 190–197, fig. 1*).—A summary of the liver fluke situation in South Wales.

Some of the physico-chemical properties of the virus of hog cholera, H. C. H. KERNKAMP (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 6, pp. 844–863, fig. 1*).—In investigations conducted it was found that hog cholera virus is not retained by the plaster of Paris magnesium oxide (electropositive charged) filters of Kramer. The virus passed the ultrafilter when 2 per cent collodion membranes were used. It is concluded that the size of the virus of hog cholera is less than 35$\mu\mu$. The precipitate remaining after virus serum was dialyzed in running water for eight days produced hog cholera when injected into susceptible pigs.

A list is given of 23 references to the literature.

Canine distemper vaccine, R. A. KELSER (*Mil. Surg., 64 (1929), No. 6, pp. 857, 858*).—Reference is made to the work of Laidlaw and Dunkin (E. S. R., 59, p. 676), which has shown that *Bacillus bronchisepticus* plays only a secondary rôle in canine distemper.

"The outstanding result of the study is the development of a tissue vaccine which will effectively immunize susceptible animals against subsequent natural infection as well as against artificial infection with live virus. Dogs which

have been vaccinated with this tissue vaccine can, 10 days subsequently, be given an injection of an attenuated strain of living virus and their immunity is further increased and of a very lasting nature."

Gymnopleurus sinnatus as the intermediate host of Spiruridae found in the vicinity of Mukden, South Manchuria.—I, Gymnopleurus sinnatus as the intermediate host of Spirocerca sanguinolenta and inquiry into Grassi's experiment with Blatta orientalis, S. ONO (*Jour. Japan. Soc. Vet. Sci., 8 (1929), No. 1, pp. 51–58, pls. 3; Japan. abs., pp. 55–58*).—The author has proved by infestation experiments with dogs that *G. sinnatus* is the intermediate host of *S. sanguinolenta* in the vicinity of Mukden, its larvae especially invading the wall of the aorta.

[Work in avian pathology at the Rhode Island Station] (*Rhode Island Sta. Rpt. [1928], pp. 47, 48*).—Referring briefly to further experiments with internal disinfectants (E. S. R., 59, p. 677), in which Metaphen (diacetoxymercuri-4-nitro-2-cresol) was tested on 24-hour-old chicks, doses as large as 0.8 cc. of 1:500 solution were found to be nontoxic. The death rate of naturally and artificially infected chicks was not reduced by its use in the drinking water.

Of 1,209 birds vaccinated to ascertain the value and efficiency of securing cutaneous immunity to fowl pox, 1,203 birds gave positive reactions and 6 gave negative reactions, 6 of the positive reactors showing comb lesions. The egg production following vaccination was very slightly decreased for a period of 10 days. None of the vaccinated birds contracted the disease, while a considerable number of unvaccinated birds showed symptoms.

Post-mortem examinations made on 62 cases of fowl paralysis which were advanced to a point where the birds were unable to have the slightest use of their legs revealed the fact that none were free from parasites, the vast majority being heavily infested with either nematodes or cestodes. There was no indication that any specific factor is responsible for the paralysis.

In a number of pullorum disease experiments made in an attempt to discover the methods of transmission, *Bacterium pullorum* was administered with the following mortality: Hypodermic inoculation into the windpipe 65 per cent mortality, feeding in gelatin capsules 28 per cent, exposure in the same pen with infected chicks 12 per cent, and droppings added to drinking water 16 per cent. No infection resulted from the administration of droppings added to feed nor from the confinement of normal chicks in infected pens. In studies made of various methods and media which might give a higher percentage of positive isolations of the organism, an adaptation of a "Tetrathionat" medium gave a higher percentage of positive isolations from droppings and organs of infected chicks.

Brief reference is made to work with blackhead in turkeys, 127 cases of which were examined. Twelve of these were treated with various therapeutic agents, 3 making complete recovery.

Nodular lesions caused by (Bacillus) Salmonella pullorum in the chick [trans. title], C. TRUCHE and J. BAUCHE (*Bul. Acad. Vét. France, 2 (1929), No. 4, pp. 134–138, fig. 1; abs. in Compt. Rend. Soc. Biol. [Paris], 100 (1929), No. 12, pp. 989–991*).—In reporting upon the lesions found at post-mortem examination, attention is called to the occurrence and structure of two types of nodules met with in chicks affected with the subacute form of pullorum disease. These nodules, detected in the lungs, heart, and gizzard, have not heretofore been reported from France, although recorded by Graham and other American investigators.

The isolation of Bacterium pullorum from a European bullfinch (Pyrrhula europa), C. B. HUDSON and F. R. BEAUDETTE (*Jour. Amer. Vet.*

Med. Assoc., 74 (1929), No. 6, pp. 929–932).—In this contribution from the New Jersey Experiment Stations the authors report that pure cultures of *B. pullorum* were obtained from the heart blood and liver of a European bullfinch which had succumbed 2 or 3 days after purchase from a large importer in New York City.

Eradication of pullorum disease in Massachusetts, 1928–1929, W. R. HINSHAW, E. F. SANDERS, and G. L. DUNLAP (*Massachusetts Sta. Control Ser. Bul. 48 (1929), pp. 36, figs. 4*).—This is the ninth annual progress report (E. S. R., 60, p. 670) on the work with pullorum disease (bacillary white diarrhea) in Massachusetts, where eradication rather than control has now become the objective. During the 1928-29 testing season, 304,092 tests were made on 254,512 birds in 413 flocks. There were 228 (55.21 per cent) nonreacting flocks having a total of 153,334 (60.25 per cent) birds tested; 157 of these flocks, totaling 121,277 birds, were 100 per cent tested, while the remaining 71 flocks were partially tested. Indications that progress in eradication is being made are supported by an increase of 92 flocks and 63,861 birds tested, and by the fact that there were 90 more nonreacting flocks and 72,505 more birds in such flocks than in the preceding year. The percentage of poultry population in nonreacting flocks increased from 3.98 per cent in 1927–28 to 7.55 per cent in 1928-29.

Bacillary white diarrhea: Pullorum infection of the domestic fowl, R. A. RUNNELLS (*Virginia Sta. Bul. 265 (1929), pp. 27, figs. 4*).—This report of work conducted is presented in four parts, dealing respectively with experiments conducted in 1925 and 1926 (pp. 4-12), 1926 and 1927 (pp. 12-16), 1927 and 1928 (pp. 16-23), and miscellaneous experiments and control measures (pp. 23-27). The effect of pullorum infection on adult hens; pullorum infection of eggs, an earlier account of which has been noted (E. S. R., 60, p. 670); effect of pullorum infection on fertility and hatchability of eggs and on baby chicks; consistency of reaction to blood test; age of chicks at which deaths due to bacillary white diarrhea occur; effect of pullorum infection on (1) egg production and flock income; and (2) the blood test reaction and ovaries; the rapid method agglutination test (E. S. R., 57, p. 774); vaccination against fowl typhoid interferes with test for pullorum infection, as previously noted (E. S. R., 58, p. 179); the results of four years' work in pullorum infection control in Virginia; and suggestions for the control of the disease are presented.

The author concludes that pullorum infection in mature hens can be detected with a fair degree of accuracy by the agglutination test, and that such infection causes marked tissue changes in a high percentage of the ovaries in hens that react to the test. The degree of reaction to the blood test and the extent of the disease in the ovaries do not always correspond. Failure to find the pullorum organism in all of the reacting hens may be due to (1) absence of the germ at the time of examination, (2) presence of the germ in some part of the body other than the ovary, which was the only part examined, and (3) inability to examine thoroughly every part of the ovary.

The production of a weak virulicidal serum against avian molluscum in hens, E. MEGRAIL (*Amer. Jour. Hyg., 9 (1929), No. 2, pp. 462–465*).—The author finds that a weak virulicidal serum against avian molluscum can be produced in adult hens when hyperimmunization is carried out to a high degree by intravenous injection of the virus. No demonstrable virulicidal serum was produced when injections of the virus were given intraperitoneally in adult hens. Rabbit serum could not be shown to be virulicidal even when these animals were given large amounts of the virus.

***Capillaria* in chickens,** R. GRAHAM, F. THORP, JR., and R. L. HECTORNE (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 7, pp. 1060–1063, figs. 3*).—The authors report upon two cases of infestation in Illinois. The possibility that there are two separate species of Capillaria involved is suggested by the gross lesions in

one fowl having been confined to the intestine while in several fowls examined from other flocks the crop was involved. Although it is possible that capillarids are more prevalent than supposed, yet in conducting several hundred autopsies the cases here reported represent the first time capillarids have been recognized as the pathogenic agent in farm flocks in Illinois.

Observations on the nature of the parasitic nodules in the cecal wall of chickens and the development of Heterakis vesicularis [trans. title], S. ITAGAKI (*Jour. Japan. Soc. Vet. Sci., 8 (1929), No. 1, pp. 59–73, pls. 2; Eng. abs., pp. 71–73*).—Examinations made by the author of the intestines of 620 fowls taken from poultry yards for other experimental purposes during the last year resulted in the finding of many large and small helminthic nodules in the cecal wall of 80. The larger nodules, varying in size from a linseed to a pea, were found in the subserous and muscular coats and not in the submucosa of the ceca. Each nodule was demonstrated to have contained single or several heterakid worms in various stages of development. In one such nodule, seven specimens of fully developed mature worms were contained and determined to be *H. vesicularis*. The smaller nodules were found in the submucosa of the ceca in many specimens and had a construction similar to those due to the larvae of (*Heterakis*) *Ascaridia perspicillum*.

Rickets as a secondary manifestation in coccidiosis, H. J. STAFSETH (*Jour. Amer. Vet. Med. Assoc., 74 (1929), No. 7, pp. 1069, 1070*).—The author reports having examined rachitic chicks that had been fed cod-liver oil and lime more or less continuously. Some of these chicks came from poultry establishments where everything possible was done to promote health. The chicks invariably showed extensive enteritis, usually due to coccidiosis, and it was found that the feeding of powdered milk would eliminate the trouble.

A study of coccidiosis in an isolated rabbit colony: The clinical symptoms, pathology, immunology, and attempted therapy of the disease, J. CHAPMAN (*Amer. Jour. Hyg., 9 (1929), No. 2, pp. 389–429, pl. 1, figs. 10*).—This is a report of studies of coccidiosis in an isolated rabbit colony conducted over a period of two years. The monthly mortality rate during that time ranged from 0.6 to 22.8 per cent of the total population. The clinical course of the disease was much more acute than that usually described, 85 per cent of the rabbits having died within 24 hours after symptoms first appeared. The pathology in 140 cases showed the lesions to be practically limited to the intestines, often involving the whole small intestine and the cecum, at times somewhat less in extent.

A bibliography of 48 titles is included.

The pharmacology and toxicology of tetrachlorethylene, P. D. LAMSON, B. H. ROBBINS, and C. B. WARD (*Amer. Jour. Hyg., 9 (1929), No. 2, pp. 430–444*).—The authors have found that tetrachlorethylene causes no pathological changes after absorption by inhalation. On this account the precautions necessary for the giving of carbon tetrachloride are unnecessary in giving tetrachlorethylene, although it is suggested that they be observed until this new drug has been more extensively used in man.

Further miscellaneous tests of tetrachlorethylene as an anthelmintic, A. S. SCHLINGMAN (*Jour. Amer. Vet. Med. Assoc., 75 (1929), No. 1, pp. 74–85*).—The author finds (E. S. R., 55, p. 173) that fats should be eliminated from the diet of dogs a few days prior to the administration of tetrachlorethylene if full anthelmintic effect of the drug is to be obtained. Likewise the drug should not be given simultaneously with cod-liver oil or castor oil.

"One cc. of tetrachlorethylene, in most cases, is sufficient to remove the roundworms from chickens of average size. Smaller amounts are not efficient in removing these parasites. The drug has no effect on tapeworms of chickens.

Calves 1 to 1.5 years old tolerate tetrachlorethylene in doses up to 38 cc. without displaying either clinical symptoms or post-mortem lesions of toxicity. Large doses of tetrachlorethylene can be given to adult dogs without the production of toxic symptoms other than those of dizziness in an occasional animal. These are transitory and usually disappear within a few hours. Dogs suffering from distemper tolerated the drug as well as the normal ones. Under ordinary conditions, however, it would seem advisable to postpone anthelmintic treatment with tetrachlorethylene until recovery from distemper has taken place.

"Tetrachlorethylene can be given to sheep in doses of 5 cc. and repeated at intervals of 30 days without harmful effects. Given at these intervals the drug should be effective in controlling stomach worms in sheep run on infested pastures. Used in this manner, it should also be effective in reducing infestation with nodular worms. No harmful effects should follow the use of the drug in pregnant ewes providing proper precautions are observed when they are being handled."

AGRICULTURAL ENGINEERING

Development of research in farm structures, H. Giese (*Agr. Engin., 10 (1929), No. 4, pp. 121–124, figs. 2*).—In a contribution from the Iowa Experiment Station the present situation in research in farm structures is subjected to critical analysis, and plans for the development of the work are outlined.

The conclusion is drawn that there is a definite need for facts upon which to build the program of farm building design, the research work at present being meager and scattered and the available designing data largely of a traditional character. "The situation demands cooperative effort and the formulation of a national program. . . . It is believed that this need justifies the services of a full-time coordinator to do the job. . . . His duties will include making a survey of the present activities of the various agencies interested in farm structures, a definite coordination of these into a national farm-structures program, and the proper dissemination of material to the workers."

Air permeability of building materials and building construction parts [trans. title], E. Raisch (*Gsndhts. Ingen., 51 (1928), No. 30, pp. 481–489, figs. 10*).—In a contribution from the Technical Academy of Munich the results of tests are reported made to determine the air permeability of different building materials, walls, and types of construction. From these results certain mathematical expressions for air permeability are deduced.

The results show that from the ventilation standpoint the air renewal through walls and other building parts is inadequate. This is especially true with reference to plastered walls. On the other hand, it was found that the air movement through walls, and especially through and around doors and windows, should be of particular concern from the heating standpoint.

With brick walls it was found that the greatest passage of air takes place throught the mortar bond. The passage of air through a single brick was in no manner representative of the passage through a brick wall, especially where a mortar bond was used.

Plaster coatings on brick walls were found to have a much lower permeability than the wall itself. The resistance of the plaster to air penetration was increased by whitewashing. The resistance of plastered wood walls to air penetration compared well with that of plastered brick walls. Results are also reported for unplastered wood walls, doors, and windows.

The preservative treatment of farm timbers, G. M. Hunt (*U. S. Dept. Agr., Farmers' Bul. 744, rev. (1928), pp. II+34, figs. 19*).—This is a revision of a

publication previously noted (E. S. R., 35, p. 843). Practical information is given on methods of prolonging the life of fence posts and other farm timbers by preservative treatment.

Dairy barns from a manufacturing point of view, H. B. White (*Agr. Engin., 10 (1929), No. 4, pp. 117–120, figs. 2*).—In a contribution from the Minnesota Experiment Station the results of a study of 100 dairy barns in eight counties of Wisconsin are reported, the purpose of which was to ascertain (1) the cost per stall for dairy cows and also the cost per animal actually sheltered and (2) the comparative labor requirements in caring for dairy cows as influenced by barn arrangement. The method of procedure was to study at least 50 barns of various arrangements and secure data as to the plan, size of stalls, gutters, mangers, and alleys. The cost of the barns and the number of stalls and the number of cows sheltered gave information in considering barn equipment. From the barns measured several of each arrangement, such as crosswise, face in, face out with litter alley, and face out with driveway, were studied for length of route in doing chores.

The cost of 50 barns was found to average $5,225. The average for the 20 barns in which route studies were made was $5,131.50. The cost per stall was $199.65 and per cow sheltered at the time the survey was made $244.35.

The average stalls, mangers, and gutters for 77 barns gave width of stalls 3⅓ ft., length approximately 5 ft., gutter 1⅓ ft., and manger 2⅓ ft. The area occupied per cow equals 28⅓ sq. ft. A barn 34 ft. wide, which was the average for the 100 barns, occupied by two rows of cows will have in 3⅓ ft. of its length 113⅓ sq. ft. Two cows in this length occupy 56⅔ sq. ft., or just 50 per cent of the barn. This means that 50 per cent of the floor area is for convenience of the man doing chores.

The average height of ceiling for the 100 barns was 8 ft. 11 in. The fact that there were in the 100 barns 15 per cent of the stalls empty shows where more attention should be given if efficiency is to be maintained.

The route distance per cow is for the crosswise arrangement 27.7 ft., the face-in 16.5, face-out (litter alley) 26.1, and the face-out (driveway) 25.7. The milk route is 9.5 ft. per cow when crosswise, 10.5 ft. for face-in, 9.8 ft. for face-out (litter alley), and 9.5 ft. for face-out (driveway).

The greatest variation in route distance is in the manure removal. The crosswise and face-in are both 8.3 ft. while the face-out (litter alley) is 7.1 ft. and the face-out (driveway) is 3.7 ft. The total distance per cow for the five chores of feeding hay, silage, and grain and the operation of milking and manure removal is for crosswise 45.6 ft., face-in 35.3 ft., face-out (litter alley) 43 ft., and face-out (driveway) 38.7 ft.

A comparison of crosswise and lengthwise shows that the route distance per cow is nearly 19 per cent greater for the crosswise arrangement than for lengthwise.

Use of the torsion dynamometer for the investigation of agricultural machines and implements [trans. title], W. Gorjatschkin (*Technik Landw., 9 (1928), No. 10, pp. 233–236, figs. 15*).—A torsion dynamometer developed at the Moscow Agricultural Academy for the testing of agricultural implements is briefly described, and some of the results of its use with different machines are reported.

The requirements of the general-purpose farm tractor, D. C. Heitshu (*Agr. Engin., 10 (1929), No. 5, pp. 145–159, figs. 22*).—In a contribution from the Virginia Experiment Station an analytical survey of the basic requirements of the successful general-purpose farm tractor is reported, together with experimental work at the station.

The latter results indicate that the most important feature of the cultivator attachment is that it can be constructed as a separate unit from the tractor. It appears that the most important factor in the design of a successful general-purpose tractor is the steering.

The conclusion is drawn that the design of a general-purpose tractor must be a compromise. The first item to determine is whether to use the 2- or 3-row system. The advantages of the two types of tractors balance except for two points, stability and adaptation to various widths of rows. The 2-row tractor holds these advantages, but its size must be kept as small as possible. The overall height should not exceed 6 ft., and the major parts of the tractor, i. e., radiator, engine, fuel tank, etc., should be under 5 ft. The length need not exceed 10 ft. and the width is established by the rows to be worked. A maximum width of 88 in. with a tread variable from 64 to 80 in. will meet the requirements of working in rows from 30 to 48 in. in width. The vertical clearance is taken as 30 in., while the horizontal clearance will vary with the width of row.

Discussions by H. B. Josephson, R. I. Shawl, J. B. Davidson, H. E. McCray, G. W. Iverson, R. H. Driftmier, and D. B. Lucas are included.

Method of calculating number and size of tractors required for given conditions, L. N. Aginsky (*Agr. Engin., 10 (1929), No. 5, pp. 169–171, fig. 1*).—This is a translation and adaptation by E. G. McKibben of the Iowa Experiment Station of a contribution from the Grain Trust of the Union of Socialistic Soviet Republics.

It is pointed out that there are certain correlations between the area of a given farm, the necessary operations in a given crop production program, and the power required to perform these operations satisfactorily. These correlations must include the influence of crop rotation, implements available, soil, weather, and other local conditions, skill of operators, ability of manager, etc. In this paper the author has worked out these correlations mathematically in the form of clearly stated and rather convenient and easily applied equations, and has suggested a method of procedure in the application of these equations to the problem being considered.

The most important phase of the whole problem is deemed the choice of the proper size of tractor for the local conditions. Up to the present time this question has had no satisfactory solution. It is thought that the best results could be obtained with large and small tractors working together on the same farm, each being used for the operations to which it is best adapted.

Investigations on the tractive resistance of farm wagons [trans. title], M. Voelter (*Technik Landw., 10 (1929), Nos. 2, pp. 34–38, figs. 15; 3, pp. 61–64, figs. 12*).—The results of a large number of experiments on the tractive resistance of two- and four-wheel farm wagons under different conditions are reported from the mechanical department of the Agricultural Academy of Berlin.

The results with a two-wheel wagon on five different soil types indicated that tractive resistance depends mainly on the wheel dimensions on both light and heavy soils. The draft decreases as the wheel diameter increases. Four-wheel wagons with the same loads and wheel dimensions showed a lower draft than did two-wheel wagons. The draft also varied with the angle of the hitch, the optimum angle being between 12 and 20°. A uniform distribution of the load over the front and rear wheels of the four-wheel wagon was also in favor of lower draft.

Tests of the influence on draft of manner of mounting the wheels showed that the use of roller bearing axles caused a considerable saving of draft over friction bearing axles.

The use of spring hitches did not in general decrease the total draft load by smoothing out the draft curve. Increasing the weight of the wheels was without noteworthy influence on the draft of two-wheel wagons. The draft was lower where sand and dust-proof hubs were used.

The direct application of mechanical power to soil tillage, J. B. DAVIDSON and E. V. COLLINS (*Agr. Engin., 10 (1929), No. 5, pp. 165–168, figs. 11*).—In a contribution from the Iowa Experiment Station an analysis is presented of the distribution of merchanical power in its application to tillage, with special reference to the losses incurred. A brief review is also given of the various attempts made to devise direct driven tillage machines.

An analysis of the power consumption of a stubble plow indicates that almost one-half the power is required to cut the furrow slice loose, about one-third is used for turning and pulverizing, and about one-sixth is required to move the plow exclusive of useful work done on the soil. The conclusion is drawn that cutting of the soil should be reduced to the minimum, and that a shaving or slicing process is not economical of power in reducing soil.

The modified plow and pulverizer represents in its conception the advantage of the plow for covering and the efficiency of the rotary pulverizer driven by power directly by the engine through the power take-off. In this machine a share and shin section of the moldboard are used to turn a furrow slice partially over so that a revolving cylinder of pulverizer blades may act upon the slice from the rear, insuring the same trash and plant growth coverage of the plow. The pulverizer blades acting upon the loosened furrow slice may be made to produce a very high degree of pulverization for the power used.

The power requirement of the pulverizer unit can be adjusted by design as to location and speed to use almost any amount of power from a minimum of 0.5 h. p. per unit, as has been actually recorded in test. With a power consumption of 2 h. p. per unit, a high degree of pulverization can be accomplished with good soil conditions and the open pockets in the soil well closed.

The removal of that portion of the mold board which turns and pulverizes the soil provides a considerable saving in drawbar horsepower required. The average power reduction as revealed by a series of tests in corn stubble and oat stubble was 14.8 and 14 per cent, respectively, or a reduction from 10.72 to 9.11 drawbar horsepower and from 11.54 to 10.05 drawbar horsepower.

When properly set the pulverizer reaction tends to reduce the drawbar horsepower; in a rather long series of tests with an accepted adjustment this amounted to an average of a little more than 4 per cent. These reductions of drawbar horsepower go a long way toward compensating for the power used by the pulverizer.

The effect of different speeds on the power requirements of a mower [trans. title], **W. VOLLENWEIDER** (*Technik Landw., 10 (1929), No. 1, pp. 1–4, figs. 5*).—Field and laboratory experiments, conducted under Swiss conditions, on the effect of speed of operation on the useful accomplishment and corresponding power requirement of a mower are reported.

The results as a whole indicate that the efficiency of a mower decreases with increasing speed. It appears that a relatively large proportion of the power required in the operation of a mower is expended in overcoming the inertia and mechanical friction of the machine itself. This was determined on the testing stand and could be expressed in terms of heat loss. The frictional losses were found to increase almost with the cube of the speed.

The efficiency was increased by proper shaping of sickle teeth, exact alignment of the crank wheel, the use of antifriction bearings, balance of the crank shaft and pitman, and uniformity in the sickle reaction to avoid vibration.

At a forward speed of about 8 ft. per second, the power required was normally about 7 h. p., but in tough or tangled grass this could easily be increased to 9 or 10 h. p. and the efficiency decreased correspondingly. A much higher efficiency was obtained when two mowers were hitched to one tractor and operation proceeded at a lower speed.

It was found that to express power requirement in terms of unit width of swath cut does not give an adequate representation of actual conditions.

Investigations of American combines in the summer of 1928 (*Separate from Reichskurator. Tech. Landw. Ber., [1928], pp. 10, figs. 2*).—Field tests of seven American combines for harvesting and threshing barley, wheat, rye, oats, and mixtures of these grains in different parts of Germany representing variable climatic conditions are reported. The results deal especially with the handling of the grain and straw and the technical adjustments and modifications of the machines to adapt them to German conditions.

The results as a whole are taken as a warning against overoptimism for the use of the combine in Germany. While allowance is made for the limited duration of the tests and the difficulties experienced in adaptation, it was found that the total cost of the process was almost as high as harvesting with the binder and threshing separately. The indications are, however, that further development of the process and equipment along specific lines will reduce the total cost.

Common binder head and knotter head troubles, C. O. Reed and R. D. Barden (*Ohio Agr. Col. Ext. Bul. 87 (1929), pp. 48, figs. 33*).—Practical information relating to binder head and knotter head troubles and their correction is presented.

Recent developments in the construction of grain-cleaning machines [trans. title], W. Brenner (*Technik Landw., 10 (1929), No. 4, pp. 92–98, figs. 5*).—A description is given of a new grain-cleaning outfit equipped with pneumatic sieves and elevating and separating devices.

Stationary spraying systems in West Virginia orchards, F. D. Cornell, jr., and H. L. Crane (*Agr. Engin., 10 (1929), No. 5, pp. 160–164, figs. 7*).—The results of an analytical survey of the experience and recommendations of fruit growers in West Virginia using stationary spraying systems are summarized in this contribution from the West Virginia Experiment Station. No definite conclusions are drawn.

RURAL ECONOMICS AND SOCIOLOGY

The survey method of research in farm economics, J. P. Maxton (*[Gt. Brit.] Empire Marketing Bd. [Pub.] 14 (1929), pp. 38*).—This is a memorandum prepared on behalf of the agricultural economics committee of the Empire Marketing Board. The value of the survey method is discussed and illustrated by typical results in different types of studies. A brief description is given of the procedure in obtaining, assembling, and analyzing the data obtained with this method.

An appendix (pp. 35, 36) discusses some of the aspects of the measurement of profitable farming.

[Investigations in rural economics at the Ohio Station] (*Ohio Sta. Bimo. Bul. 139 (1929), pp. 137–142*).—Results of investigations are reported as follows:

Trend in prices of farm products, cash rent, and farm real estate in Ohio, R. L. Moore (pp. 137-139).—A table is given and discussed showing index numbers (1913=$100) for Ohio farm product and farm real estate prices, 1877–1928, and for cash rent per acre and cash rent in terms of real estate prices, 1900–1928.

Apple sales of an Ohio orchard company in 1928, C. W. Hauck (pp. 139–141).—Tables are given and discussed showing the number of bushels sold, value, weighted average price per bushel, and price per bushel to jobbers for fancy grades for different varieties, and the percentage of sales to different types of buyers.

Index numbers of production, prices, and income, J. I. Falconer (p. 142).—The table previously noted (E. S. R., 61, p. 482) is brought down through April, 1929.

An economic analysis of production problems in the Bitter Root Valley, S. E. Johnson (*Montana Sta. Bul. 220 (1929), pp. 123, figs. 36*).—This bulletin reports the results of a study made in the summer of 1926 and is based chiefly upon data obtained from interviews with 170 farmers on different types of farms, and from courthouse, irrigation district, railroad, local market agencies, U. S. Census, and U. S. D. A. Weather Bureau, Forest Service, and crop reporting service records.

The area, its agricultural development, and the present utilization of resources and returns from farming in the different sections of the area are described. Suggestions are made for a land development and utilization policy. The planning of effective business organizations for individual farms of different types is discussed.

Organizing the Corn-Belt farm for profitable production, H. C. M. Case, R. H. Wilcox, and H. A. Berg (*Illinois Sta. Bul. 329 (1929), pp. 257–332, pl. 1, figs. 20*).—Part 1 (pp. 259–290) analyzes and illustrates by facts from detailed records of studies in east-central Illinois the following principles of good farm organization: Good crop yields reduce production costs, higher profit crops add to total farm profits, farms with livestock show larger earnings, livestock efficiently handled reduces cost of production, a large volume of business is necessary for the best return, a good system of farming helps use labor to advantage, power should fit farm needs and be efficiently handled, equipment costs must be kept under control, well-arranged fields and farmsteads save time, diversity of production helps insure long-time profits, and production should be planned to meet market demands. The importance of these principles is discussed.

Part 2 (pp. 291–327) discusses the factors to be considered in planning a profitable system of farming for an individual farm. The value of farm planning is illustrated by a table showing the earnings, organization, and distribution of capital in 1927 on 5 successful farms in the area.

The cost of horse labor on Oregon farms, H. E. Selby, B. W. Rodenwold, and H. D. Scudder (*Oregon Sta. Bul. 250 (1929), pp. 14, fig. 1*).—This bulletin presents data regarding the cost of horse labor in different sections of the State and under different conditions as follows: (1) For 147 irrigated farms with 632 horses in 6 irrigated sections of the State and 49 farms with 195 horses in the Willamette Valley in 1926; (2) from 198 records for 3,512 horses on dry-land wheat farms in Sherman County, 1921–1922; (3) for 30 horses of a retail milk company in Portland, 1924–1928; and (4) an average of 17 horses on the State experiment farm and campus at Corvallis, 1916–1927.

Tables are given showing the average costs by groups of items and number of hours of work for each study. Other tables show variations in amount of work and costs, and relation of amount of work and size of farm to costs and of age of horses to value of horses in different sections.

The average costs per horse hour were 9.9 cts., 13, 10.9, 21.4, and 15.1 cts., respectively, and the average number of hours worked per horse annually, 825, 763, 746, 2,504, and 1,928, respectively, in the different studies.

Cost and efficiency in producing hay in the Willamette Valley, H. E. Selby (*Oregon Sta. Bul. 248* (*1929*), *pp. 48, figs. 12*).—This bulletin is based on data for 1925 to 1927, inclusive, collected by the survey method from 76 farmers for all three years, 72 farmers for two years, and 59 farmers for one year. Tables and graphs are given showing the average costs per acre by items and cash and noncash costs of producing clover, vetch-and-oats, alfalfa, and cheat hay, and the variations in costs by years, the variations in the costs of vetch-and-oats hay on different farms, the percentage of acreage covered and number of times gone over for each labor operation, and the numbers of hours of man, horse, and tractor work per acre per operation. The factors affecting harvesting efficiency and yield and the place of hay crops in the farm business of the valley are discussed.

The average costs per ton were for clover $7.08, vetch-and-oats $9.87, alfalfa $7.93, and cheat $9.93. Cash items comprised 25 per cent, 43, 24, and 41 per cent, respectively, of the average total costs of the different kinds of hay. The average return to the grower for hay sold was $9.70 per ton for clover and $11.62 per ton for vetch-and-oats hay.

What does it cost to grow a bushel of apples? F. H. Ballou (*Ohio Sta. Bul. 435* (*1929*), *pp. 20, figs. 8*).—This bulletin is based on actual costs for the years 1924 to 1928, inclusive, of growing and handling 13,900 bu. of apples on a 20-acre commercial orchard in southeastern Licking County, Ohio.

A table is included and discussed showing the yearly and 5-year average costs per bushel for pruning, fertilizing, spraying, spray materials, gasoline and lubricating oil, thinning, mowing orchard, picking, hauling, grading, supervision of packing and local sales, interest on machinery and equipment, repairs and depreciation, interest and taxes on orchard land, and cost of containers. The total costs per year varied from 60 to 90.4 cts. per bushel, averaging 69.84 cts.

Costs and practices in strawberry production in the Willamette Valley, Oregon, C. E. Schuster and A. S. Burrier (*Oregon Sta. Bul. 245* (*1929*), *pp. 43, figs. 3*).—This bulletin is based upon data obtained by the field survey method from 48 commercial growers growing 198 acres of strawberries in 1925, and 73 farms with 435 acres in 1926.

Tables are given and discussed showing size of farms; acreage and varieties of strawberries grown; investment; costs of production by items and cash and noncash costs; hours and cost of man labor for major operations; variations in cost of production; yields; effects of yields, cultivation, size of planting, and value of land on costs; labor requirements for cultural operations, harvesting, marketing, and miscellaneous operations; and costs of establishing a planting, and amount and distribution of labor in, and labor requirements for, different operations in establishing a planting. Some suggestions are made for improvements in strawberry farm organization.

The average cost of production for the two years was 5.87 cts. per pound, of which 2.9 cts. was cash cost. For 27 per cent of the acreage the total cost was 4.4 cts. per pound, for 32 per cent 5.6 cts., for 31 per cent 7 cts., and for 10 per cent 10.6 cts. The average price received was 8 cts. Yield per acre, soil fertility, variety grown, size of planting, and value of land were important factors in the costs. The average cost per acre of establishing a planting was $79.28.

Credit problems of Georgia cotton farmers, A. N. Moore, J. K. Giles, and R. C. Campbell (*Georgia Sta. Bul. 153* (*1929*), *pp. 56, figs. 5*).—This bulletin is based upon a study, made in cooperation with the Georgia College of Agriculture and the U. S. D. A. Bureau of Agricultural Economics, of the operations in 1926 of 55 Butts County and 66 Laurens County farms, of which 45 were

operated by full or part owners, 47 by croppers, and 29 by standing or share tenants.

Tables are included showing for each county and for owners and tenants the number using, average amount, average term, sources, and cost of, and security for, all short-term credit and for cash and merchant credit; comparison of operations, value of products, net worth, and years as operators, and cash in hand or on deposit of the 101 owners and tenants using credit and the 20 using no credit; relation of years of farming experience to use of credit; amount and term of merchant credit and bank credit in relation to cost; relation of total debts to assets and income, by owners and tenants in each county; number of owners and tenants using different amounts of credit; and the relation of short-term credit to operating capital and to size of farm for owners and tenants. General data are given regarding the two districts, and the relations between landlords and tenants, farm mortgage indebtedness, and methods for improving credit conditions are discussed.

Of the total short-term credit, 36 per cent was obtained from merchants, 44 from banks, 13 from landlords, and 7 per cent from other sources. Of the total amount, 34 per cent was used for living expenses, 43 for fertilizers, and 23 per cent for other farm expenses. For the owners in both counties, 78 per cent of the credit was on open account or plain note, and the balance was unendorsed credit with crop lien, chattel mortgage, or both. For the tenants, 26 per cent was on open account or plain note, 10 per cent on endorsed credit with or without crop chattel mortgage and 64 per cent unendorsed credit with crop lien, chattel mortgage, or both.

The following table shows the findings for the two counties:

Farmers using credit, average amount used, and cost of credit by kinds and sources

	Butts County		Laurens County	
	Owners	Tenants	Owners	Tenants
Farmers using short-term credit ... per cent	62	89	81	90
Average amount of short-term credit	$788	$228	$240	$258
Average term of short-term credit ... months	8.1	7.5	6.6	6.5
Cost of credit per annum:				
All short-term credit ... per cent	8.7	18.4	19.3	23.5
Merchant credit ... do	18.3	21.7	30.4	28.5
Cash credit ... do	8.0	16.6	10.6	14.9
Cost of cash credit by source:				
Banks ... do	7.8	11.4	10.7	14.8
Landlords ... do		20.0		9.5
Other individuals ... do	8.4	10.9	11.7	13.0

Farm income and taxation in North Carolina, G. W. Forster, H. W. Hawthorne, G. S. Klemmedson, and H. H. Wooten (*North Carolina Sta. Bul. 267 (1929), pp. [2]+46–188, figs. 11; reprinted from Report of the Tax Commission of North Carolina. Raleigh: State, 1928, pp. 46–188, figs. 11*).—This is based on data from 1,156 farms operated by owners and 416 rented farms in 11 typical areas in 25 counties in the Mountain, Piedmont, Coastal Plain, and Tidewater regions of North Carolina, obtained from the owner-operated farms by enumerators, using the regular farm-management schedule for the Southern States of the U. S. D. A. Bureau of Agricultural Economics; and from the rented farms by personal interviews and mailed questionnaires, using a field schedule. The areas studied and the conditions prevailing in 1927 as compared with other years are described. The data regarding incomes of the owner-operated and

rented farms in the several areas and regions are presented and discussed. The tax burden on farming in the different areas is analyzed and comparison made between the areas and with other States. The methods of assessing and equalizing tax valuations in the different areas and the effects of unequal assessment are discussed.

The average return on capital invested for the 11 areas was 5 per cent, ranging from —3.8 to 18.6 per cent, and being less than zero in 5 areas. The returns on investment on rented farms in the different regions were Mountain 0.8, Piedmont 2.5, Coastal Plain 4.3, and Tidewater 1.8 per cent. The tax burdens in the 4 regions were, respectively, as follows: Per acre, 67, 64, 92, and 72 cts.; per $100 invested, $1.45, $1.03, $1.30, and $1.44; and percentage of net incomes (Mountain region net income negative), 28.2, 11.3, and 23.5 per cent. While approximately 84, 88, 89, and 72 per cent, respectively, of the net incomes in the 4 regions were from zero to $200, the ratio of taxes to net income decreased to 7 and 3.4 per cent, respectively, for incomes in excess of $2,000 in the Mountain and Piedmont regions, and to 4 and 6.1 per cent, respectively, for incomes in excess of $4,000 in the other regions. Taxes absorbed an average of 39.2 and 26.5 per cent, respectively, of the net rents on cash and share-rented farms.

A comparison of the average of 3 independent estimates and the assessed values on 1,057 farms showed that the average assessed valuation was only 75 per cent of the estimated market value, and that 4.5 per cent of the farms were assessed at 30 per cent or less of the estimated value, 3.4 per cent at over 150 per cent, and only 16.7 per cent within 10 per cent of the estimated value. The tendency appeared to be to assess small and large farms heavier than intermediate size farms.

The commission concludes that taxes on agriculture are heavy generally and especially so in the areas where incomes have been relatively low, that the present methods of assessing and appraising farm property for taxation purposes are defective and should be remedied, and that the tax burden is often heavy because of poor farm management and organization and inadequate methods of marketing agricultural products.

Immigrant farmers and their children, E. DE S. BRUNNER (*Garden City, N. Y.: Doubleday, Doran & Co., 1929, pp. XVII 277, figs. 9*).—This volume reports the results of a study made in 1926 and 1927 by the Institute of Social and Religious Research of foreign-born farmers and their children in the United States.

Part 1 (pp. 1–136) covers the general phases of the study—number, distribution, and characteristics of foreign-born farmers, their success, intelligence tests of children of immigrants, intermarriage, social life, and the church in the immigrant community.

Part 2 (pp. 137–243) includes case studies of four different types of immigrant communities as follows: Castle Hayne: A Study of an Experiment in the Colonization of Foreign-Born Farmers in North Carolina, by R. W. McCulloch (pp. 139–154); Askov: A Study of a Rural Colony of Danes in Minnesota, by D. Lloyd (pp. 155–182); Petersburg: A Study of a Colony of Czecho-Slovakian Farmers in Virginia, by N. Anderson (pp. 183–212); and Sunderland: A Study of Changes in the Group Life of Poles in a New England Farming Community, by T. Abel (pp. 213–243).

Agricultural reform in the United States, J. D. BLACK (*New York and London: McGraw-Hill Book Co., 1929, pp. X+511, figs. 22*).—This book discusses the issues of agricultural reform likely to come before the people of the United States in the next 10 years. The material is considered in parts, dealing with

(1) the present status and place of agriculture in the national economy and relief programs; (2) the effect of surpluses on prices and incomes, gains from holding such surpluses until later years, and seasonal surpluses and the gains from holding such surpluses during the year; (3) price raising by Government action through tariff revision, the equalization fee, export debentures, domestic allotment and other plans, and the feasibility of price raising; (4) adjustment through assisted laissez faire, cooperative action, and stabilization corporations and other quasi-public agencies; and (5) reforms in production, land utilization, marketing, transportation, immigration and farm labor, credit, and taxation.

Agricultural relief: A selected and annotated bibliography, compiled by E. M. Colvin (*U. S. Dept. Agr., Bur. Agr. Econ., Agr. Econ. Bibliog. 27 (1929), pp. III+52*).—A mimeographed selected and annotated bibliography of the more important references issued from January, 1924, to May, 1929.

The Government's policy toward the cooperative movement, A. M. Hyde (*U. S. Dept. Agr., Off. Rec., 8 (1929), No. 32, pp. 1, 2, 8*).—An address by the Secretary of Agriculture at the fifth summer session of the American Institute of Cooperation, Baton Rouge, La., July 29, 1929.

Agrarian policy, F. Aereboe (*Agrarpolitik. Berlin: Paul Parey, 1928, pp. XII+619*).—This volume on German agrarian policy outlines the economic and sociological foundations of an agrarian policy and discusses the important problems and their solutions relating to population, distribution of land, rural education, taxation, tariff, credit, farm labor, land settlement, and rural organization. Bibliographies on the several subjects are included.

Marketing problems and developments (*Natl. Assoc. Marketing Off. Proc., 10 (1928), pp. 102*).—This is the proceedings of the tenth annual meeting of the National Association of Marketing Officials, held at Chicago, December, 1928. Included are the following addresses and discussions thereon: Opening address, by H. D. Phillips (pp. 5–7); Foreign Markets for Agricultural Products and the Competition of Foreign Agricultural Producers in Our Domestic Markets, by N. A. Olsen (pp. 8–21); Our Market Outlook in Central Europe, by J. C. Marquis (pp. 21–25); Clearing House Organization Development—Eastern, by F. B. Bomberger (pp. 25–32); Reaction of Chain Store Policy on Producers, by J. E. Boyle (pp. 33–40); The Rejection Evil, by S. R. Brown (pp. 40–48); Regulating the Commission Merchant, by W. A. Sherman (pp. 48–52); Developments in Market Information Service in California, by B. H. Critchfield (pp. 52–54); The Place of Future Trading in the Marketing of Grain, by J. W. T. Duvel (pp. 55–59); Price Analysis as a Basis for Effective Marketing Programs, by O. C. Stine (pp. 59–65); Market Legislative Information Service, by H. F. Fitts (pp. 66–68); and Progress in Poultry and Egg Standardization, by R. C. Potts (pp. 68–71).

Also given are the minutes of the business meeting, a list of officers and committees, and reports of the committees on cooperative organization, market reporting, city markets, standardization and inspection, sales and consignments, transportation, legislation, and livestock and crop estimates, with discussions.

Forecasting wheat yields from the weather, C. L. Alsberg and E. P. Griffing (*Wheat Studies, Food Research Inst. [Stanford Univ.], 5 (1928), No. 1, pp. [1]+44*).—This paper brings together "what is known concerning the forecasting of yields of wheat from the weather," discusses the status of existing knowledge of the problem, and suggests some lines of improvement. The material is discussed under the following headings: Preliminary considerations, weather factors in plant growth, plant reactions to weather factors, some interrelations of growth factors, methods of forecasting yields from the

weather, pitfalls of correlation analyses, and present results and lines of improvement. A bibliography is included.

A weighted series of cash wheat prices at Winnipeg, M. K. Bennett et al. (*Wheat Studies, Food Research Inst.* [*Stanford Univ.*], *5* (*1929*), *No. 5, pp.* [*1*]+*175–206, figs. 4*).—A series of weekly prices from the week ended August 5, 1922, to the week ended March 30, 1929, is presented. This series was computed by weighting the weekly Winnipeg prices of straight grades Nos. 1, 2, 3, 4, 5, and 6 northern Manitoba wheat and feed wheat and of tough grades Nos. 1, 2, 3, 4, 5, 6, and feed wheat by the percentage each grade bore of the total inspections at Winnipeg. The weekly prices of the tough grades Nos. 4, 5, 6, and feed wheat were estimated by subtracting from the weekly average prices of the straight grades of the same designations the weekly average discount of tough No. 3 wheat under straight No. 3 wheat. The percentages of tough grades inspected were estimated by assuming that each grade of tough wheat constituted the same percentage of all tough wheat inspected as each straight grade constitutes of all straight wheat inspected. The inspections of the 14 grades exceeded 91 per cent of the total inspections during each year included. Durum wheat and the less important grades of wheat were not considered in computing the weighted weekly price series. The ways in which the weighted series fall short of being perfectly representative of cash wheat prices at Winnipeg are discussed.

Graphs showing the following are included and discussed: (1) The weighted cash price series and weekly average Winnipeg prices of No. 1 northern, No. 5, and feed wheat, weekly from August, 1922; (2) the relations between cash prices of Nos. 1, 4, 5, and 6 at Winnipeg and the weighted cash price series in terms of deviations from the prices of No. 3 northern Manitoba wheat, weekly from August, 1922; (3) the relations between the weighted cash price series and futures prices in terms of deviations from the weekly prices of No. 3 northern Manitoba wheat for the crop years 1922–23 to 1927–28, inclusive; and (4) the weighted cash price series and the prices of No. 1 northern Manitoba and No. 3 northern at Winnipeg and the British parcels prices, weekly from August, 1922.

The appendix includes tables showing the average closing prices of Nos. 1, 2, 3, 4, 5, and 6 wheat, feed wheat, and tough Nos. 1, 2, and 3 wheat, and the weighted averages, weekly from the week ended August 5, 1922, to and including the week ended March 30, 1929; and the inspections of Nos. 1, 2, 3, 4, 5, and 6 wheat, feed wheat, no grade wheat, and other wheat at Winnipeg, weekly from the week ended August 4, 1922, to and including the week ended April 1, 1929.

Oregon apple prices by variety, grade, and size, 1922–1926, R. S. Besse and M. R. Cooper (*Oregon Sta. Bul. 244* (*1929*), *pp. 24, figs. 4*).—This bulletin, prepared in cooperation with the Bureau of Agricultural Economics, U. S. D. A., is based upon data for 8,607,119 boxes of graded and packed apples of 22 varieties shipped from the seven leading apple sections of the State during the years 1922 to 1926, inclusive.

Tables are included showing (1) by years, the total shipments and average prices paid to growers by varieties and grades per box, average prices by sections, distribution of shipments by grades and by size of apples, average prices by varieties, grades, and size of apples, and destination of shipments (1922–1925) by geographical divisions; (2) by sections, the total shipments, distribution of shipments and prices by varieties, distribution by grades, and destination (1922–1925) of carload shipments by varieties; and (3) for the period, the average prices and distribution of shipments by grades, and distribution, total and by sections, of shipments by size of apples and varieties.

Yellow Newtown and Esopus Spitzenburg comprised 51.4 and 23.5 per cent, respectively, of the total shipments. The weighted average price to growers for the period was $1 per box, ranging from 76 cts. to $1.46 for the different years. The price of different varieties ranged from 33 cts. to $1.39 per box.

The consumer demand for apples, L. P. JEFFERSON (*Massachusetts Sta. Bul. 250 (1929), pp. 53–71, figs. 6*).—This bulletin is based on the following data: Estimated receipts in the Springfield trade area; records of the Nashoba Apple Packing Association for the four seasons 1924–1927; about 1,400 questionnaires to housewives in Massachusetts (E. S. R., 56, p. 689), Rhode Island (E. S. R., 55, p. 81), and Connecticut; and reports of the U. S. Department of Labor.

Tables and graphs are given showing the average prices to growers, 1924–1927, of different varieties, grades, and sizes of apples; average prices, 1925 and 1926, of ungraded apples by varieties; sources of purchases of housewives; variety preferences for eating raw and cooking in Connecticut, Rhode Island, and Massachusetts; trends in population and consumption of apples in the United States, 1918–1927; rate of movement of apples out of storage in Boston, November, 1925, to August, 1926; and comparison of indexes of prices of Baldwin apples with indexes of (1) industrial money wages, 1907–08 to 1927–28, and (2) real wages in Massachusetts manufacturing industries, 1889–90 to 1923–24. The preferences of housewives as to variety, size, color, etc., ability to recognize varieties, size of purchases, etc., are discussed.

No correlation was established between wages, nominal or real, and the price of apples, nor between real wages and per capita consumption.

Buying tomatoes on grade, 1928, F. C. GAYLORD and H. M. CLEAVER (*Indiana Sta. Bul. 328 (1929), pp. 16, figs. 6*).—Data are included as to grades of tomatoes delivered to 9 factories buying on grade in 1928, and comparisons are made with deliveries to factories in 1927.

Rural community halls in Montana, J. W. BARGER (*Montana Sta. Bul. 221 (1929), pp. 52, figs. 20*).—This bulletin describes and discusses the methods of establishing, controlling, financing, and operating community halls in the State, the location, buildings, and equipment of such halls, the uses made of them, and their social value. Plans for three buildings are included.

Reports obtained showed 167 such halls in the State, 28 of which were schoolhouses or in connection with schools, 13 privately owned, and 18 no longer in use. Exclusive of unpaid labor on buildings, the cost of the halls for which data were obtained ranged from $260 to $15,000, averaging $2,170, and the annual maintenance was from $100 to $4,000, averaging $761.

The study was made in cooperation with the U. S. D. A. Bureau of Agricultural Economics.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Part-time instruction in vocational agriculture for Virginia, E. C. MAGILL and R. W. CLINE (*Va. Polytech. Inst. Bul., 22 (1928), No. 1, pp. 74, fig. 1*).—This bulletin is based upon an investigation conducted during 1926–27 by Cline to determine the possibilities of part-time instruction in a typical Virginia county and the best recognized and tried procedure for organizing and conducting a part-time class. The method of determining the advisability of conducting a class, securing a class, determination of the enterprise to be taught, planning and laying out courses, final preparations, planning the lesson, teaching the class, directing supervised farm practice, determining results, and reporting work are described.

A recommended program for Virginia is included.

Twenty-sixth general report of the Department of Agriculture and Technical Instruction for Ireland, 1927–28 (*[Irish Free State] Dept. Agr. and Tech. Instr. Gen. Rpt., 26 (1927–28), pp. V+185*).—A continuation of the series previously noted (E. S. R., 60, p. 489).

The status of agricultural education, 1924–1926 [trans. title], H. BAELS (*Min. Agr. [Belgium], Situation Enseig. Agr. Rap. Trien., 1924–1926, pp. 29, pls. 4*).—The report of the Minister of Agriculture for the years 1924, 1925, and 1926, presented to the 1927–28 session of the House of Representatives of Belgium.

Home economics teacher training under the Smith-Hughes Act, 1917 to 1927, G. A. BRANEGAN (*Columbia Univ., Teachers Col. Contrib. Ed., No. 350 (1929), pp. [X]+159, figs. 12*).—The main sources of data for this study were the official documents in the office of the Federal Board for Vocational Education, the chief primary sources being the yearly State plans for 1917–1921 and the 5-year plans for 1922–1927 and 1927–1932 of each of the 48 States, and the reports of the Federal agents.

The development of home economics training prior to 1917 and the organization and administration of the State and Federal boards are described. The organization and trends of the work in the 71 institutions approved under the National Vocational Education Act for teacher training of white teachers are analyzed, and the accomplishments during the decade are summarized.

Social aspects of homemaking, W. M. BOMAR (*Philadelphia & London: J. B. Lippincott Co., 1929, pp. [VII]+197, figs. 44*).—A text for high school home-making courses for use as a companion volume to laboratory texts.

Strength of materials, M. MERRIMAN, rev. by T. MERRIMAN (*New York: John Wiley & Sons; London: Chapman & Hall, 1928, 7. ed., rev. and reset, pp. X+204, figs. 60*).—A textbook for secondary technical schools.

FOODS—HUMAN NUTRITION

Relative economy of the various cuts of pork, S. BULL and J. H. LONGWELL (*Illinois Sta. Bul. 330 (1929), pp. 333–347, figs. 13*).—In connection with swine-type experiments previously reported (E. S. R., 61, p. 460), 12 hogs were slaughtered at live weights of approximately 175 lbs. each, 161 at 225 lbs., and 13 at 275 lbs. Each of the carcasses was divided into the usual wholesale cuts and the proportion of each of these cuts to the total carcass determined. Each cut was then separated into lean, fat, skin, and bone and each of these constituents weighed. Tables are given of the average results obtained for the different weight groups. As these figures showed no material differences in physical composition of the cuts from the different weight groups, the figures for the 225-lb. group were used in constructing a graph showing the proportion of lean, fat, skin, and bones in the various cuts and also in charts from which calculations can be made of the cost per pound of the lean meat and of the total edible meat in the different cuts. The graphical method on which these charts are based is explained in Bulletin 234 (E. S. R., 46, p. 365).

A typical illustration is given of the use of these charts. At market prices for the different cuts of ham 40 cts. per pound, loin 40, belly 50, Boston 30, picnic 25, spareribs 20, neck bones 10, and sausage 25 cts., the neck bones, sausage, spareribs, and picnic cuts proved much more economical as sources of lean than the belly, ham, and loin. Calculated in terms of edible meat (lean and fat), the belly, ham, and loin again ranked more expensive than the other cuts. Considering the amount of fat wasted, ham was in most cases by far the most expensive of the pork cuts.

The publication includes photographs and descriptions of the various cuts.

Food values of New Zealand fish.—Part X, Seasonal variations in Stewart Island oysters, J. Malcolm (*New Zeal. Inst. Trans. and Proc., 59 (1928), pt. 4, pp. 668–677, fig. 1*).—Continuing this series of experiments (E. S. R., 60, p. 93), monthly analyses from March to October, inclusive, of freshly gathered New Zealand oysters and vitamin A determinations on the same are reported.

The glycogen content showed a more or less gradual decrease as the season advanced. The fat, protein, and ash showed little variation. The content of vitamin A was lower in the winter months of June, July, and August than in March to May and showed a marked increase in September. Oyster spawn, spawned oysters, and canned oysters showed considerable amounts of vitamin A.

In reporting the vitamin data a new method of expressing the value of growth curves was followed. The rats were kept on the basal diet alone until they began to lose weight and showed eye symptoms and then were given the oyster supplement for 10 days, after which the basal diet alone was fed until death. The cages were not cleaned for at least 10 days after the return to the basal diet in order to allow the rats access to their feces. The growth curves were plotted and a horizontal line drawn connecting the point at which the feeding of the oyster supplement was begun and the point at which the weight had fallen to the same as at the beginning of the oyster feeding. The area bounded by this line and the growth curve between these points is called the area of growth and is thought to be of comparative value in indicating the extent of storage of vitamin A.

The chemical composition and food value of Oregon dried prunes, J. S. Jones and D. E. Bullis (*Oregon Sta. Bul. 249 (1929), pp. 12, fig. 1*).—The analytical data reported include the percentages of pits, flesh, and moisture in flesh, and percentages of acid and sugars in the dry flesh of Italian and Petite varieties of dried prunes of the crop of 1925; percentages of invert sugar and sucrose in fresh and dried Italian prune flesh; and percentages of inorganic constituents of prune flesh (Italian), in terms of dried flesh (14.2 per cent moisture), ash from the flesh, and whole prune (pit and flesh) as received. In making the analyses, the various market grades were regraded by a gravity process into four gravity grades for each commercial grade of the Italian and five for the Petite variety. From the analyses of the various gravity grades weighted averages were calculated for the commercial grades.

The minimum and maximum values for moisture were 11.89 and 13.69 per cent for the Petite and 16.41 and 20.3 for the Italian varieties. It is stated that for the best keeping qualities the moisture content should not exceed 20 per cent. The values for acid varied from 2.38 to 3.85 per cent in the Italian and from 1.35 to 1.69 per cent in the Petite variety, and for sugars from 54.12 to 59.02 in the Italian and from 66.69 to 69.9 per cent in the Petite. Attention is called to the fact that a difference of several per cent in the sugar content of prunes may not be detected by the taste, while a difference of 0.5 to 1 per cent in the acid content is noticeable at once. The average values for invert sugar and sucrose in the fresh Italian prunes were 7.42 and 4.46 per cent, while in the dried prune flesh corresponding values were 41.27 and 3.08 per cent.

In dried Italian prunes nitrogen-containing compounds calculated as crude protein constituted 2.7 per cent of the flesh. In the dried flesh (14.2 per cent moisture), total ash amounted to 2.008 per cent, iron 0.0061, calcium 0.0672, and phosphorus 0.0573 per cent. In terms of the various food essentials it is estimated that 1 lb. of dried Italian prunes as purchased may reasonably be expected to furnish 700 calories of heat energy, 9 gm. of protein, 0.25 gm. of

calcium, 0.2 gm. of phosphorus, and 22 mg. of iron. Or, if expressed in percentage of the requirements of an adult performing light manual labor, 1 lb. of Oregon-grown Italian prunes will meet 21 per cent of his energy requirement and 9, 32, 13, and 146 per cent, respectively, of his protein, calcium, phosphorus, and iron requirement.

Foods and drugs, J. M. BARTLETT (*Maine Sta. Off. Insp. 131 (1929), pp. 16*).—This is the annual tabulation of the results of the examination of food and drug samples collected by the division of inspections of the State department of agriculture (E. S. R., 60, p. 289). The food samples included 8 of ice cream, 41 of oysters, and 61 of sausage.

Dietary studies of farm families in Albany and Lincoln Counties, Wyoming, E. J. MCKITTRICK (*Wyoming Sta. Bul. 165 (1929), pp. 133–148*).—Nineteen records obtained by the accounting method for a two weeks' period are included in this study. Twelve of these were from Albany County, of which Laramie is the county seat, and seven from Star Valley, Lincoln County, located 60 miles from any railroad. In the analysis of the data, the Hawley double dietary scale was used. Ten of the 12 dietaries from Albany County and 4 from Lincoln County were found to be more than adequate according to the standards used. The average cost of the diet per male unit for the two weeks' period was $5.77 for the first group and $3.40 for the second group.

Muscular efficiency on high carbohydrate and high fat diets, M. E. MARSH and J. R. MURLIN (*Jour. Nutrition, 1 (1928), No. 2, pp. 105–137, fig. 1*).—Data obtained in a previous study (E. S. R., 60, p. 193) are here analyzed for the muscular efficiency, while riding a bicycle ergometer, of a single subject, an athlete, on high carbohydrate and high fat diets. A total of 47 experiments is reported, 12 of which were made while the subject was on a normal ad libitum diet.

The high carbohydrate and high fat diets contained, respectively, 2,400 and 2,800 calories daily, of which in the former 80 per cent came from carbohydrate, 12 from fat, and 8 from protein, and in the latter 80 per cent from fat, 12 from carbohydrate, and 8 from protein. Two series of experiments at different rates of work were run on each of these diets nearly equally distributed between postabsorptive experiments and experiments from 4 to 5 hours after a meal rich in carbohydrate or fat. The work lasted for 8 minutes and was followed by from 17 to 25 minutes of rest in each case. The urine was collected in two periods, the first including the prework resting period and the second work, recovery, and a postwork resting period. The extra metabolism due to work was found by subtracting from the total metabolism for the work and recovery periods the prework resting metabolism calculated each time to the same length of period.

At the rate of 1.4 calories of work per minute, the average net efficiencies were 22.1 per cent for the normal diet, 22.7 for the high carbohydrate, and 21.5 for the high fat diets. At the rate of 1.1 calories per minute the values were 23.4 per cent for the high carbohydrate and 22.6 for the high fat diets. On the high carbohydrate diet there was no progressive change in the efficiency, but on the high fat the efficiency progressively declined after the third or fourth day. The average difference in efficiency between the high carbohydrate and high fat in the first series, calculated to pure carbohydrate and pure fat combustion, was 11 or 12 per cent (relative).

"A difference in the diminution of nitrogen excretion from prework to work and recovery periods was noted on the high carbohydrate as compared with the high fat diet. This difference is due to the greater sparing effect of increased carbohydrate combustion. Relative to the increase in carbohydrate

calories, the decreased protein metabolism was the same on both diets, but since it is total metabolism which affects efficiency, the effect of the greater sparing of protein (on high carbohydrate) depends upon whether the protein calories replace nonprotein under the conditions of these experiments. Direct calorimetry would be required to settle this question. The effect of the specific dynamic action of higher protein and fat metabolism would require blood analyses which were not attempted in these experiments."

Improved rate of growth of stock albino rats, A. H. Smith and F. C. Bing (*Jour. Nutrition, 1 (1928), No. 2, pp. 179–189, figs. 2*).—This is a statistical study of growth data for the stock rats in the authors' laboratory. The ration employed is the Sherman diet B, modified by replacing half of the added sodium chloride with an equal weight of calcium carbonate to improve the calcium: phosphorus ratio and by adding fresh lettuce daily. Female rats are not bred until about 3 months of age and are given 9 gm. of dried yeast per week during the lactation period of 21 days. A resting period of two weeks is allowed between each weaning and remating, and no female is bred more than three times. The litters are reduced to eight at birth.

The best-growing stock animals were comparable in size to the selected groups of Osborne and Mendel (E. S. R., 56, p. 191) and of Mendel and Cannon (E. S. R., 58, p. 592). At 30 days of age the average weights of males and females were 66 and 63 gm., respectively, and at 200 days the average weight of the males was 423 gm. Slight seasonal differences in growth rate were noted, corroborating the finding of Hanson and Heys (E. S. R., 57, p. 825).

Following the method of Brody and Ragsdale (E. S. R., 45, p. 378), the calculated weight of male rats between the ages of 21 and 65 days were found to show a fairly close agreement with the observed values. Between 65 and 235 days there was quite a close agreement.

The authors emphasize the fact that environment plays a large part in enabling hereditary growth factors to exert their full influence, and that these newer growth curves should not be applied uncritically by workers in other laboratories where the conditions may not be as favorable.

Lactation vs. improved growth in stock albino rats, A. H. Smith and W. E. Anderson (*Science, 70 (1929), No. 1804, pp. 98, 99*).—A brief note calling attention to lactation difficulties manifesting themselves in the fifth generation rats on the stock diet described in the paper by Smith and Bing noted above. "The present communication does not invalidate the data of the previous publication, but does call attention again to the differences in the nutritional demands for growth and for lactation. Moreover, in view of the wide use of the whole wheat-whole milk powder ration in its various modifications, our observations may be significant in calling attention to possible cumulative deficiencies in such restricted food mixtures for reproduction and lactation."

Recent advances in our knowledge of vitamins, R. F. Hunwicke (*Quart. Jour. Pharm., 1 (1928), No. 4, pp. 581–589*).—A review of recent literature on vitamins A and D, B, C, and E. A list of 27 references is appended.

Nutritional significance of our present knowledge of the multiple nature of vitamin B, H. C. Sherman (*Jour. Nutrition, 1 (1928), No. 2, pp. 191–199*).—This is an editorial review dealing with the literature on the differentiation of vitamin B and the interpretation in terms of the two factors now identified in what was formerly known as vitamin B of some of the earlier studies from the author's laboratory on the stability of vitamin B.

A bibliography of 38 titles is appended.

Does commercial insulin contain what has hitherto been called vitamin B? C. J. Stucky (*Arch. Int. Med., 42 (1928), No. 6, pp. 780–783, fig. 1*).—This

paper contains the experimental data leading to the conclusion as noted in a previous paper by Stucky, Rose, and Cowgill (E. S. R., 61, p. 193) that commercial insulin contains no appreciable amounts of the vitamin B complex. It is also noted that negative results have been obtained in a few tests with pigeons, using insulin as the sole source of the antineuritic vitamin (F), but that no work has been done to determine whether or not it contains the heat-stable factor (G).

Some notes on the chemistry of the fat-soluble vitamins in cod-liver oil, A. L. BACHARACH and E. L. SMITH (*Quart. Jour. Pharm., 1 (1928), No. 4, pp. 539–545, fig. 1*).—Evidence that the Zucker process of preparing a concentrate of vitamin D from cod-liver oil by extraction with 95 per cent alcohol and saponification of the extract (E. S. R., 49, p. 608) separates vitamin A from vitamin D is presented as follows:

Extracts thus prepared, when tested by the fecal pH test, have been found to contain vitamin D in amounts varying from 80 to 95 per cent of that contained in the original oil, but no vitamin A as judged by the antimony trichloride and biological tests. The spent oil was found by both of these tests to contain vitamin A. That no great loss in A had occurred during the extraction of vitamin D was further shown by the fact that the color tests of the spent oil were practically the same as of the original oil.

These observations are thought to indicate that vitamin B is present in cod-liver oil in a form which is soluble in ethyl alcohol and vitamin A in an insoluble form. The fact that total saponification and extraction of the unsaponifiable matter from cod-liver oil yield both A and D in the unsaponifiable matter which is soluble in alcohol is explained on the assumption that vitamin A is present in cod-liver oil as an ester which is itself insoluble in alcohol, but rendered soluble by saponification. The bulk, but not the entirety, of vitamin D is assumed to be in the free state and thus soluble in alcohol.

The variations in the amounts of the antirachitic vitamin in different samples of cod-liver oil, milk, and butter, K. H. COWARD (*Quart. Jour. Pharm., 1 (1928), No. 4, pp. 534–538*).—Attention is called to wide variations in the vitamin D content, as determined by the unit method noted previously (E. S. R., 59, p. 689), of different selected cod-liver oils of supposedly high quality and of samples of butter collected at different seasons of the year. Data are also reported for three samples of milk, two from the London supply of November, 1927, and August, 1928, respectively, and one from an experimental farm in August, 1928. The first and third of these samples were almost entirely devoid of vitamin D and the other had a value of only 0.2 unit per gram.

The author is of the opinion that while diets containing plenty of milk and butter may furnish sufficient vitamin A this is not often true of vitamin D, and that additional sources of this vitamin should be furnished. The importance is urged of correct statements on food and medicinal preparations containing vitamin D concerning their content of this vitamin in order that proper doses may be given. It is also noted that no concentrate can be considered a complete substitute for cod-liver oil unless it contains vitamin A as well as vitamin D.

Conditions for the formation and destruction of vitamin D during the course of irradiation of ergosterol [trans. title], D. VAN STOLK, E. DUREUIL, and HEUDEBERT (*Compt. Rend. Acad. Sci. [Paris], 187 (1928), No. 19, pp. 854–856, fig. 1*).—The authors have irradiated a thin 1.5 mm. layer of 0.05 per cent solution of ergosterol in alcohol in an atmosphere of nitrogen, and have photographed the spectra obtained at the end of 15, 30, 45, and 60 minutes.

The original ergosterol had well-defined absorption bands at 2,932, 2,815, 2,700, and 2,600 a. u. During irradiation the first three bands disappeared, and the fourth increased in intensity simultaneously with the appearance of two new bands having maxima at 2,503 and 2,405 a. u. The first of these developed an intensity equal to 2,815 and 2,700 bands of ergosterol. After three hours the new bands had not disappeared, but after six hours they were less intense. It is concluded that the reaction ergosterol → vitamin D → decomposition product is a phenomenon of oxidation, and that the final destruction of vitamin D is due not to destructive radiations emitted by the mercury lamp but to an oxidation which, in alcoholic solution, can not be avoided entirely, but which can be reduced considerably by operating in an atmosphere of nitrogen.

Vitamin requirements of nursing young, III, IV, B. Sure (*Jour. Nutrition, 1 (1928), No. 2, pp. 139–164*).—In continuation of the series of studies previously noted (E. S. R., 59, p. 894), two further studies are reported in which the author had the technical assistance of D. J. Walker and the cooperation of E. H. Stuart.

III.—*A quantitative biological method for the study of vitamin B requirements of nursing young of the albino rat* (pp. 139-153).—The principle established in a previous study (E. S. R., 59, p. 490) of the distribution of vitamin B between the lactating mother and nursing young has been applied to the development of a quantitative method for determining the vitamin B content of various concentrates in terms of the requirements for nursing young. Adjusting the amount of vitamin B fed the mother to maintenance values only, the established unit for vitamin B is the daily amount which must become available to a nursing young rat weighing 30 gm. in order to permit a gain of 10 gm. in from 7 to 10 days. In the experiments which were conducted to establish this unit striking demonstrations were obtained of the inability of lactating rats to transfer vitamin B to the milk. While 500 mg. of a yeast concentrate proved insufficient in some cases when fed to the mother alone, a lactation efficiency index of 95.5 per cent was secured in a series of experiments with 23 lactating rats and 133 young on 118 mg. distributed between the mother and the young.

In terms of the unit established, 1 gm. of dehydrated baker's yeast, Federal brand, was found to contain 7 units of vitamin B and various concentrates to contain from 14.4 to 125 units per gram.

IV.—*Vitamin B v. vitamins A and D requirement for growth of nursing young of the albino rat* (pp. 155–164).—In this paper further evidence is afforded of the inefficiency of lactating rats in furnishing vitamin B to their nursing young as compared with vitamins A and D, and the consequently greater need of providing additional sources of vitamin B to nursing young. Approximately 100 times as much dehydrated baker's yeast was required as a source of vitamin B for nursing young as was necessary of cod-liver oil as a source of vitamins A and D for continuous growth throughout the nursing period.

The discussion of these results includes a summary of the pathological symptoms of vitamin B deficiency in nursing young as reported in previous papers, and a reiteration of the author's belief that it is as necessary to provide additional sources of vitamin B in infant feeding as orange or tomato juice for C and cod-liver oil for A and D.

Vitamin requirements of nursing young (Mus norvegicus albinus).—V, Hypoglycemia in nursing young suffering from vitamin B deficiency, B. Sure and M. E. Smith (*Soc. Expt. Biol. and Med. Proc., 26 (1928), No. 1, pp. 72, 73*).—A preliminary report is given of a study of the effect of a deficiency of the vitamin B complex in the diet of the lactating mother on the total blood sugar content of the nursing young. When the vitamin B administered to the

mother was limited to such amounts as would provide for maintenance but not growth of the litter, the sugar content of the blood of the young showed a progressive decrease as compared with a progressive increase in the sugar content of the blood of control litters receiving sufficient vitamin B from the maternal diet.

Vitamin requirements of nursing young.—VI, Anhydremia associated with disturbance in hematopoietic function in nursing young of the albino rat suffering from a deficiency of the vitamin B complex, B. SURE, M. C. KIK, and D. J. WALKER (*Jour. Biol. Chem., 82 (1929), No. 2, pp. 287–306, figs. 7*).—The authors have determined the hemoglobin and erythrocyte counts of the blood of nursing rats in various stages of avitaminosis produced by a deficiency of the vitamin B complex and in the recovery period following the administration of vitamin B. Total blood solids and in some cases the concentration of serum proteins as determined by the refractive index were also determined.

The data thus obtained all pointed to the development of anhydremia accompanied by marked disturbances in the hematopoietic function in vitamin B deficiency. Of the 125 pathological nursing young examined, only 16 showed pronounced anemia as evidenced by low hemoglobin and erythrocyte counts. In the few cases in which vitamin B therapy was attempted marked success followed. In one instance, during a period of 11 days of maintenance of weight on restricted vitamin B intake there was a loss of only 2 gm. in body weight, but the hemoglobin was reduced from 11 to 4 gm. per 100 cc. of blood and the erythrocyte count from 6.5 to 2.8 millions per cubic millimeter of blood. A potent yeast concentrate was then administered daily, and in the 15 days following there was an increase of 55 per cent in body weight, 200 per cent in hemoglobin concentration, and 157 per cent in red blood corpuscles.

Effect of vitamin deficiencies on carbohydrate metabolism.—I, Hypoglycemia associated with anhydremia and disturbance in hematopoietic function in nursing young of the albino rat suffering from uncomplicated vitamin B deficiency, B. SURE and M. E. SMITH (*Jour. Biol. Chem., 82 (1929), No. 2, pp. 307–315, figs. 3*).—This paper reports an extension of the study reported in paper 5 of the series noted above of the effect of the deficiency of the vitamin B complex on the total sugar content of the blood of nursing rats and a repetition of the work limiting the deficiency to the antineuritic vitamin. Previous results indicating the development of hypoglycemia during vitamin B deficiency were confirmed, and the same phenomenon was found to take place following a deficiency in the antineuritic vitamin. This hypoglycemia developed at a stage in the avitaminosis before the loss in body weight occurred and was accompanied by anhydremia and in some cases by a reduction in the concentration of hemoglobin. Vitamin B therapy brought about a rapid increase in the concentration of blood sugar and a regeneration of hemoglobin, both at a much more rapid rate than the increase in body weight.

Actinic measurement of solar ultra violet light and some correlations with the erythema dose, F. O. TONNEY, P. P. SOMERS, and W. C. MARTI (*Jour. Prev. Med., 2 (1928), No. 6, pp. 493–511, figs. 9*).—A simple chemical method originally described by W. T. Anderson, jr., and F. W. Robinson[8] for standardizing quartz mercury vapor lamps has been applied to the quantitative estimation of the ultra-violet light in direct sunshine throughout the year in Chicago, Ill. The data thus obtained have been correlated with the erythema

[8] Jour. Amer. Chem. Soc., 47 (1925), No. 3, pp. 718–725, fig. 1.

reactions of the skin following exposure to the sun's rays throughout the same period.

The seasonal curves of maximum monthly hourly actinic readings considered with the erythema findings indicated high ultra-violet value in unobscured sunshine at Chicago throughout the year except during the months of November, December, and January. The average monthly readings, however, showed a prolonged season of low ultra-violet light in actual available sunshine. This was brought out even more strongly in the total erythema sunshine hours, which ranged from 149 hours per month in June to none in November, December, and January. The quantity and quality of the solar ultra-violet light available from September to March, inclusive, were so low as to be of no practical value.

TEXTILES AND CLOTHING

An explanation of some statistical methods used in textile research (*Didsbury, Manchester: Brit. Cotton Indus. Research Assoc., Shirley Inst., 1929, pp. 17, pls. 2, figs. 2*).—This pamphlet is designed to explain to the general reader statistical terms used in Shirley Institute Memoirs.

Technological reports on standard Indian cottons, 1929, A. J. Turner (*Indian Cent. Cotton Com. [Bombay], Technol. Bul., Ser. A, No. 12 (1929), pp. IV+125, figs. 24*).—The present edition, resembling previous reports in scope, includes the results of tests on the standard Indian Cottons of the 1928–29 season, with comparative and summarized data from earlier crops (E. S. R., 59, p. 693).

The medullated wool fiber, J. F. Wilson (*Hilgardia [California Sta.], 4 (1929), No. 5, pp. 135–152, figs. 4*).—The origin, cause, characteristics, distribution, and textile significance of medullated wool fiber are described, with accounts of physical tests and outlines of methods for the detection of such fibers.

Medullated fiber is found on many kinds of animals, probably among all of the breeds of sheep, and is common in breeds producing the coarser grades of wool. Distribution studies (E. S. R., 61, p. 260) indicated that this is likely to be found in any part of the fleece, although it is most apt to occur in the rear portions, notably on the lower thigh. Some sheep are entirely free from this defect.

Medullated fibers were found to be stronger than nonmedullated fibers of the same diameter at the midsection. Tests on the extension at break indicated that nonmedullated fibers may be more elastic than medullated fibers of equivalent midsection diameter. It is observed that the medullated fiber is partially responsible for wide deviations from the mean diameter of fiber of the fleeces in which it occurs.

Penetration of ultra-violet rays through fabrics, A. Latzke (*Amer. Jour. Hyg., 9 (1929), No. 3, pp. 629–645*).—In this study the penetration of ultra-violet rays through various fabrics (wool batiste, cotton sheeting, linen sheeting, and silk crêpe de chine) was measured by the germicidal action of the rays upon cultures of *Escherichia coli* with which the fabrics were impregnated, and also when the fabrics were used as a screen for the light. The fabrics selected were white or uncolored of approximately the same interspace, and corresponding samples dyed black in the laboratory.

It was found that a 10-minute exposure to ultra-violet rays was more effective in its germicidal action on white cotton, linen, and silk fabrics than on wool having a similar percentage interspace. When the fabric was used as a screen for the light rays and the time of exposure was kept uniform, black was

found to offer more protection against bactericidal action than white materials of similar interspace, and cotton and wool more protection than silk and linen.

"When the length of time of exposure varied according to ratios established with sensitized paper and the bacteria screened by black fabrics were given three times as long irradiation as those screened by the white, light through the black fabrics was more effective as a germicide than through white material. This tends to establish the fact that the size of interspace is of greater importance is transmitting ultra-violet rays of germicidal power than is the color of the fabric."

The consumer and branded goods, K. T. Cranor and C. L. Scott (*Textile World, 74 (1928), No. 26, p. 28*).—A brief report is given of the responses of 500 consumers and 57 manufacturers of well-known brands of textiles to questionnaires concerning the use of branded and unbranded textiles, the guaranties of the manufacturers concerning branded textiles, and the reliability of these guaranties. Various suggestions are given to the consumer for the intelligent purchase of textiles.

MISCELLANEOUS

Report on the agricultural experiment stations, 1928, E. W. Allen, W. H. Beal, H. M. Steece, et al. (*U. S. Dept. Agr., Off. Expt. Stas., Rpt. Agr. Expt. Stas. 1928, pp. 104*).—This report, commented on editorially on page 601, includes a discussion of the activities of the stations during the fiscal year ended June 30, 1928; a résumé (pp. 30–73) entitled Some Recent Results, containing summaries by H. C. Waterman, H. M. Steece, J. W. Wellington, W. A. Hooker, G. Haines, H. W. Marston, S. L. Smith, R. W. Trullinger, and E. Englund; a special article (pp. 73–76) entitled Some Recent Developments in Agricultural Research in the British Empire, by H. L. Knight; a list classified by subjects of the publications of the stations received during the year; and Statistics, 1928, by J. I. Schulte (pp. 95–104).

Thirty-sixth Annual Report [of Minnesota Station], 1928, W. C. Coffey (*Minnesota Sta. Rpt. 1928, pp. 63*).—This contains the organization list, a report of the director on the work and publications of the station, including brief abstracts of articles contributed to outside publications, and a financial statement for the fiscal year ended June 30, 1928.

Forty-first Annual Report of [Rhode Island Station, 1928], B. E. Gilbert (*Rhode Island Sta. Rpt. [1928], pp. 42–54*).—This report includes experimental work and meteorological data, for the most part abstracted elsewhere in this issue.

Science in the Netherlands East Indies, edited by L. M. R. Rutten (*Amsterdam: K. Akad. Wetensch. ([Internatl. Circumpacifische Onderzoek Com.]), [1929], pp. VIII+432, pls. 3, figs. 119*).—This book, prepared for distribution at the Fourth Pacific Science Congress, contains among other data the following chapters: The Climate of the Netherlands East Indies, by C. Braak (pp. 50–64); The Development and the Present-Day Stand-Point of Scientific Veterinary Research in the Netherlands Indies, by L. de Blieck (pp. 227–254); Chemistry, by P. van Romburgh (pp. 255–267); and On Agricultural Research and Extension Work in the Netherlands Indies, by C. J. J. van Hall (pp. 268–275).

NOTES

California Station.—Among recent gifts for the support of research in the station are $1,500 from the Fintana Farms Company for work on swine diseases, $2,000 from the Sardine Canners' Association for an investigation of fish meal for poultry feed, and $1,601 supplied by various organizations and individuals to provide equipment for an investigation of problems appertaining to cold storage of fruits in ocean transport, now being prosecuted by Dr. E. L. Overholser on the S. S. *Silverhazel* on a trip to the Orient.

The 1929 Conference on the Cooperative Meat Project.—The 1929 conference on the national cooperative project dealing with the factors which influence the quality and palatability of meat was held at Chicago from August 14 to 16. It was attended by representatives of the U. S. D. A. Bureaus of Agricultural Economics, Animal Industry, and Home Economics, and the experiment stations of the States of California, Colorado, Illinois, Indiana, Iowa, Kansas, Maryland, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Jersey, New York, North Carolina, North Dakota, Oregon, Virginia, and West Virginia. The National Livestock and Meat Board and the American Aberdeen-Angus Breeders' Association were also represented.

The conference dealt with results of experiments conducted at the different stations, with plans for the future, and also in considerable detail with meat research methods. Its work was handled largely through 10 committees and subcommittees, dealing, respectively, with the influence of (1) age, (2) sex, (3) breeding, (4) grass versus grain, (5) degree of finish, and (6) ration and management upon the quality and palatability of beef; the influence of (7) castration, (8) breeding, and (9) ration upon the quality and palatability of lamb; and (10) pork projects.

Reports and recommendations on methods were submitted by standing committees on (1) feeding, (2) slaughtering, (3) laboratory procedures, and (4) cooking. Subcommittees on special phases of laboratory methods reported on (a) tenderness and texture, (b) histology, (c) bound and free water, and (d) color. A committee was appointed on methods of grading animals and carcasses.

In general the cooperative meat investigations have hitherto considered both beef and lamb to a much greater extent than pork. The conference felt that more attention should be devoted to pork studies. It also approved a recommendation that the work previously conducted as cooperative soft-pork investigations be expanded to cooperative quality-in-pork investigations and made a part of the national cooperative meat project.

The conference was deemed a distinct success from every viewpoint. It showed that much progress has been made in improving methods of meat research, in outlining and attacking the problem, and in obtaining results. This national project has given animal husbandry research a greatly broadened field, which promises valuable results for the consuming public as well as for the livestock and meat industries.

Office of Experiment Stations.—Dr. Edwin West Allen, associated with the work of the Office since 1890 and chief since 1915, died suddenly in Chicago, November 11, while awaiting the convention of the Association of Land-Grant Colleges and Universities. An editorial account of his life and services will appear in the December issue of the *Record*.

EXPERIMENT STATION RECORD

Vol. 61 DECEMBER, 1929 No. 8

On the eve of the 1929 conventions of the Association of Land-Grant Colleges and Universities and the American Society of Agronomy, to whose respective calls for service he was responding with characteristic zeal and enthusiasm, Dr. Edwin West Allen, chief of the Office of Experiment Stations, passed away. Stricken on the train while en route to the place of meeting, he reached the hotel on the morning of November 11 seemingly well on the road to rapid recovery, but a few hours later a second attack ended his life with dramatic suddenness. His body was escorted from Chicago to Washington by former colleagues of the Department of Agriculture, and after due tribute in funeral services found burial in his home town of Amherst, Mass.

By a tragic coincidence, one of Dr. Allen's immediate duties at Chicago was to have been the presentation of a memorial address in honor of his lifetime friend and coworker, the late Dr. A. C. True. For considerably more than a generation they had labored side by side for the upbuilding through the State experiment stations of a strong national system of agricultural research. Parted by the hand of death for a few months only, they have again been linked together in men's minds in an association comparable to the historic partnership of Lawes and Gilbert at Rothamsted.

It was in 1890 that Dr. Allen received his initial appointment in the Office of Experiment Stations and became the fourth member of the notable group of pioneers consisting of Drs. Atwater, Harris, and True. Like his three colleagues, he had been born and reared in New England and had received his undergraduate education within its borders. Unlike them, however, he was a product of the land-grant college. Graduating in 1885 from the Massachusetts Agricultural College, he had served three years in the Massachusetts Experiment Station as a chemist under the tutelage of its first director, Dr. Charles A. Goessmann. A desire for the advantages of advanced training had led him logically to the University of Göttingen, from which Dr. Goessmann had come and to which other alumni of the college had turned.

Returning to this country from Germany with the coveted degree of doctor of philosophy, Dr. Allen entered upon his life work well equipped with the sound basic training which he was to advocate so consistently for others. Although the Massachusetts Agricultural College in the early eighties was small and struggling for existence in an unfriendly environment, it gave at that time, in the words of Dr. True's recent history, "relatively strong instruction in languages, mathematics, chemistry, botany, and zoology, and coupled this with definite teaching of the relations of the natural sciences to agriculture and horticulture and of the practices of these arts." Similarly the newly established Massachusetts Experiment Station, although largely occupied with the fertilizer control work, was broadly administered and dominated by the research spirit. As for graduate work in agricultural chemistry and related fields, the German universities are conceded to have been at that period without serious competition. Added to these educational assets were his plentiful stock of native ability, his high ideals tempered by common sense, a capacity and liking for hard work, and an abundance of youthful energy, making an unusual endowment for a career of leadership.

As in the case of his predecessors in the Office, Dr. Allen's early service was mainly in connection with its publications. He was put to work immediately on *Experiment Station Record*, handling for a time its abstracts of foreign work and for several years its departments of chemistry, foods and animal production, and dairying This experience was doubtless very helpful in familiarizing him with the status of research in these important fields and with the prevailing methods of publishing the results of station work. Eventually he became a recognized authority on research publications, and in one way and another did much to improve their effectiveness.

In 1899 he succeeded Dr. True as editor of the *Record* and continued in that capacity for nearly 25 years. Under his supervision the general policies and standards of the periodical were maintained at their previous high levels and with considerable expansion and improvement from time to time, but his conspicuous contribution was in the enlargement and development of the monthly editorials. In this feature he saw and utilized effectively a unique opportunity for making the *Record* not merely an abstract journal, but an organ to serve the interests of the experiment stations by the periodic discussion of their current problems and needs. Not all of the hundreds of editorials which appeared were written by him personally, but so long as his name headed the title-page fully half of the total each year were the product of his pen, and all passed under his guiding hand. This was a heavy burden when combined with his administrative responsibilities, but it was a service for which he developed

unusual aptitude and which doubtless helped appreciably in shaping the course of agricultural research at a time when the enunciation of broad general principles and the putting forward of specific constructive suggestions were alike much needed.

In 1893 the functions of the Office of Experiment Stations, hitherto largely those of a clearing house of information, were greatly broadened by legislation directing the Secretary of Agriculture to scrutinize the expenditures of the stations under the Hatch Act. What this innovation meant to the stations and to the Office has been discussed in these columns so recently in connection with the life and work of Dr. True that it may here suffice to say that in the difficult task of visitation and establishing closer relations the services of Dr. Allen were a positive and potent factor. Named assistant director of the Office in 1893, he had from the beginning a large share in the framing of policies and the execution of plans. In the work of inspection he proved a tower of strength, thorough, alert, and scrupulously zealous to guard the Federal funds, but ever chiefly regardful of the spirit and broad purposes of the law. In the words of a resolution adopted by the subsection of experiment station work of the Association of Land-grant Colleges and Universities, "his attitude was ever sympathetic, his analysis of a proposition always constructive, and his suggestions a great help in clarifying a situation. His visits to the State stations were always welcome because of his helpful sound advice. We shall miss his wise counsel. He had a large vision of the work and service of the experiment stations to agricultural development, and his every endeavor was to help forward a clearer and more definite vision of the task to be done. This vision was nation-wide."

The passage of the Adams Act in 1906 brought new responsibilities to the Office and a fresh opportunity for leadership. An enlightened interpretation of original research as distinguished from other experimental activities was necessary, and the beginning of the system of advance approval of projects operating under Federal funds raised numerous delicate and important questions. Partly by his editorial and other writings, but even more by his personal contacts with station people and their organizations, Dr. Allen exerted an influence upon research in dealing with these matters which was ever widening in scope and appeal.

The reorganization of the Department of Agriculture in 1915, whereby the Office of Experiment Stations became a unit in the States Relations Service under Dr. True as director, resulted in the appointment of Dr. Allen as chief of the Office. Thenceforth the responsibility of leadership in the administration of station affairs rested squarely upon his shoulders, but such had been the gradual evolution of the task and of the man that the change of

title was mainly an official recognition of a status already tested and found good.

In the years which followed, important problems crowded hard upon one another. The readjustments in station work resulting from the passage of the Smith-Lever Act, the serious emergency situations created by the World War and its aftermath, the reorganization of the work upon the dissolution of the States Relations Service in 1923, the greatly increased activities brought about by the Purnell Act, and the present period of awakening interest in cooperation and coordination in research, all these were matters which demanded and received from him a high order of leadership.

The Purnell Act in particular he regarded as an outstanding challenge to the stations and their personnel. Trebling, as it now has done, the Federal grants to the stations, he was insistent that the new resources should be utilized to the greatest possible advantage. Their application to definite pieces of investigation of substantial character was firmly advocated, and clear expression was given to his belief that the occasion called for "a high degree of ability in management, an organization responsive to the needs and capable of so functioning as to present a united attack, and a personnel commensurate with the best attainable." Here as at other times he was, as Dr. A. F. Woods, Director of Scientific Work of the Department, has recently stated, "always constructive in his criticism and helpful in his attitudes." The notable results which have been attained since the passage of the act afford plentiful testimony as to the wisdom and success of his policies.

So too in the matter of cooperation and coordination in research, perhaps the most important matter pending at the present time, he early took advanced ground and maintained it to the end. Without in any way seeking to impair the independence or integrity of the individual stations or their workers, he pointed out in the report which he prepared for the joint committee on projects and correlation of research a few days before his death that "research ought not to be regarded merely from the local standpoint. The experiment stations constitute a national system and they bear an intimate relation to the Federal Department of Agriculture. Correlation of their efforts is essential to economy of effort and efficient progress. After it has been effected there will still remain sufficient individual opportunity and institutional initiative for self-expression." Such a position might have been regarded coldly a few years previously, but it received the unanimous indorsement in turn of the committee and the station group. Other evidences of an increasing acceptance and appreciation of his efforts in this direction were accumulating, and announcement had recently been made of the designation of Dr. Allen as the assistant director of scientific work of the Federal Depart-

ment of Agriculture in addition to his previous duties, with a view to bringing about greater correlation of investigations by the Department, the stations, and other agencies.

A firm believer in the effectiveness of group contacts in promoting the cause of research, Dr. Allen was inevitably a zealous and diligent worker in many organizations interested in its upbuilding. Foremost among these was the Association of Land-Grant Colleges and Universities. He was an attendant and close observer at most sessions of this body since 1891, and a frequent participant in its proceedings since 1910 when he read his first paper, entitled Scope, Purpose, and Plans of Adams Fund Investigation. Other papers followed in increasing number, no fewer than seven being accredited to him since 1924. Perhaps even more arduous and influential was his committee service. He was continuously on the committee on experiment station organization and policy from 1911, frequently as secretary, preparing and presenting many of its reports and exerting at all times a strong impress upon its findings in the many important matters with which it was called upon to deal. He was one of the Department's representatives on the joint committees on projects and correlation of research and publication of research and here also rendered active and unique service. In 1923 he was elected to the permanent position of recording secretary of the subsection on experiment station work and came to exert much influence upon its programs and policies. From 1910 to 1912 he was vice president of the association itself.

Other research groups claimed much of his time and accorded him many honors. He was a fellow of the American Association for the Advancement of Science and keenly interested in the formation of its section on agriculture, of which he served as secretary from 1914 to 1918 and as vice president in 1920. He was long a member of the Society for the Promotion of Agricultural Science and its secretary from 1910 to 1914. Since 1917 he had been a member of the National Research Council.

To an ever increasing degree he was besought with invitations for addresses from subject-matter societies and at one time or another had appeared before most of the groups which deal with the several phases of agricultural science. The final paper which he completed before his death was prepared for the American Society of Agronomy on the topic Initiating and Executing Agronomic Research. Such opportunities for a hearing he regarded very highly and accepted freely, for he saw clearly that progress in research is advanced or retarded by the human element as by no other factor and that these societies have great potentialities as stimulants and supports in their respective fields. Speaking with a force and facility of expression which commanded attention and carried con-

viction, his views were welcomed in the councils of specialists and administrative officers alike.

Special mention needs be made of his services to research through a number of other agencies. One of these was the *Journal of Agricultural Research*. A member of the editorial committee of the journal from its establishment in 1913 and its chairman since 1924, he exercised large influence on its standards and policies. As Dean Hills of Vermont has said in his keenly appreciative tribute, given at Chicago, "hundreds of manuscripts from scores of departmental research workers passed over his desk and were scanned by him in his capacity as editor, representing the Department in this great joint enterprise of the Department and this association. Many, doubtless most, of these manuscripts saw light dressed in the print of the journal—but who shall say how many of the presentations were made better, clearer, more effective because he had dealt with them?"

Another characteristic venture was the enlightening and inspiring course on the nature and method of research offered at his suggestion and presented under his direction in the Graduate School of the Department of Agriculture in 1924. This educational experiment was broadly conceived and ably conducted in the conviction that interest in the fundamental principles of research could be stimulated by formal instruction in its history, aims, and methods. Much of its success was doubtless due to his large personal contribution.

Still a third type of activity was his participation in such movements as the recent New York survey of the research and experimental work under way in that State. "Chosen as the best qualified man in the country," in the words of a statement by the Cornell University authorities, his analysis of the situation was "penetrating, comprehensive, sympathetic, and helpful."

In what has been said, emphasis has necessarily been directed to Dr. Allen's immediate connection with the development of agricultural research, but the picture would be distorted if the impression were given that this concentration of his energies was in any sense because his viewpoint was narrowly specialized or restricted. Fundamentally he was interested in all that concerned the upbuilding of agriculture and country life and beyond that in the growth and prosperity of the entire nation. These broader interests found expression in his personal participation year after year in the preparation and revision of general articles on agriculture and its various phases for encyclopedias, yearbooks, and other works of reference; his regard for sound scholarship, recognized in his selection as the first president of the Washington alumni chapter of the honorary fraternity Phi Kappa Phi; and perhaps most notably in his service as executive secretary of the Roosevelt Commission on Country Life.

In this connection it is important to recall that with him participation meant more than perfunctory passivity. Once enlisted in a cause, he could be counted upon not merely for his full share but to the limit of his time and strength. For the week of the Chicago meetings his program included the presentation of two important papers, the preparation of three committee reports, and an active part in a large number of personal and group conferences. Yet it was no heavier than he had handled ungrudgingly and with unstinted energy for many years.

His career as a whole has been well summarized by President Brooks of the University of Missouri when conferring upon him last June the honorary degree of doctor of laws in the following language: "As chief of the National Office of Experiment Stations, you have insisted on the highest standards and encouraged fundamental research in the sciences. As editor and author, you have done notable work in advancing the cause of scientific agriculture. As supervisor of Federal funds appropriated to the colleges and universities of this country for the benefit of agriculture, you have been ever alert, discriminating, and effective." Another revealing tribute is contained in the closing words of the resolution adopted by the subsection on experiment station work at Chicago, in which it was pointed out that he has "rendered this service to agriculture and to his fellow workers at a peculiarly difficult period when the development of men and methods was no less important than the exploration of new fields of research. He successfully solved the problem of administering a national enterprise through local agencies."

Dr. Allen's sudden death creates a vacancy which will be very hard to fill. Born on October 28, 1864, he had barely passed his sixty-fifth birthday, and many years of unique usefulness seemed ahead of him. Well prepared in the beginning, he had never ceased to grow with his opportunity, and his long and matured experience was being confidently relied upon for many days to come. Yet the inevitable regret at his abrupt passing from the field in which he was so exceptionally qualified, so diligent, and so devoted may well be tempered by the reflection that at least he was spared long months of lingering illness and enforced inactivity, which for one of his ardent temperament would have been peculiarly hard to bear. He died in harness, active and productive to the end, leaving an inspiring record of many things done well and an influence which has permeated every experiment station in the land. Of the many workers who have wrought vigorously and well in the realm of agricultural research, it may be questioned whether any has rendered more effective leadership or more substantial service.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

The incompatibility between any theory of complete dissociation and migration data for divalent ions, J. W. McBain and P. J. Van Rysselberge (*Jour. Amer. Chem. Soc., 50 (1928), No. 11, pp. 3009–3017*).—The results presented in this contribution from Stanford University consist primarily in those of measurements of the migrations of cadmium, magnesium, lithium, potassium, and calcium in 0.05 M solutions of their salts, the solutions containing at least one divalent ion. In each case there was added a relatively large proportion, usually sufficient to give a concentration of 0.95 M either of a sulfate or of a chloride. The migration of the anion was found to have been suppressed, often reversed, in the case of the addition of a sufficient excess of chloride or sulfate ions to the 0.05 M solutions of salts containing a divalent ion. This finding is considered to show the combination of the sulfate or chloride ions with undissociated molecules to form complex ions.

"Such migration is incompatible with the assumption that salts containing polyvalent ions are completely dissociated except in extreme dilution."

The effect of the position of substitution on the ionization constants of some organic acids, D. A. MacInnes (*Jour. Amer. Chem. Soc., 50 (1928), No. 10, pp. 2587–2595, figs. 4*).—Chlorinated or hydroxylated alipathic acids were found to have ionization constants corresponding to the formula

$$\log K_a = C + S\frac{1}{d}$$

C and S being constants, with d equal to unity for the α-position, to 2 in the case of the β-position, etc. It is noted that this equation corresponds theoretically to a repulsion proportional to the inverse square of the distance between the polar bonds of the carboxyl and the substitution groups, together with a free energy of ionization increasing in proportion to the mutual potential energy of the two groups.

"The ionization of the chlorine substituted benzoic acids follows the same formula accurately if the ortho distance is equal to the α-distance and a slightly 'puckered ring' structure for the benzene nucleus is assumed.

"The constants for bromine and iodine substituted aliphatic acids show small systematic deviations from the equation, although the corresponding aromatic compounds agree with it closely."

Physico-chemical aspects of soil acidity (*Michigan Sta. [Bien.] Rpt. 1927–28, p. 4*).—A study of a number of the normal and of the isomeric forms of organic acids showed the normal acids to be adsorbed to a greater extent than were the corresponding isomeric forms. The difference decreased with increase in the length of the carbon chain. The introduction of polar groups lessened adsorption to a degree dependent both upon the nature of the polar group and, in the case of the aromatic acids, upon the orientation of the substitution group in the benzene nucleus.

The adsorption of the organic bases, unlike that of the inorganic bases, was positive, with an increase in the extent of the adsorption with increase in the length of the carbon chain. "These results are striking evidence that in adsorption phenomena chemical constitution and configuration of the molecules of the substance adsorbed are most important factors determining the adsorbability."

With the use of the information gained in the research above briefly summarized, an investigation was made of the part played by adsorption in determinations of soil acidity. It was demonstrated definitely in this work that the sugar inversion method does not measure the total acid content of the soil, and considerable evidence indicating the inversion of sugar in acid soils by soluble acids only, to the exclusion of insoluble acid alumino silicates, was also obtained.

The toxic property of sulfur, R. C. WILLIAMS and H. C. YOUNG (*Indus. and Engin. Chem.*, *21 (1929), No. 4, pp. 359–362*).—Ordinary pure commercial sulfur used as a fungicide was found in the investigation here reported from the Ohio Experiment Station to have associated with it sulfuric, sulfurous, and polythionic acids. Freed from this last-named group of oxidization products, the sulfur was no longer toxic to spores of *Sclerotinia cinerea*. The greater part of the acidity of filtrates from sulfur which had been thoroughly wetted was found due to sulfuric acid. A solution of pure sulfuric acid having a total acidity the equivalent of that of the filtrate from the wetted sulfur was not toxic, however.

In the control of *Venturia inaequalis*, artificially oxidized sulfur preparations were very effective when the oxidation was not so vigorous as to destroy the polythionic acids (tetra and pentathionic acids). Calcium pentathionate was found not toxic, though the free acid, considered to be formed readily on foliage, etc., sprayed with lime-sulfur mixtures, was very effective.

Methods used for the determination of sulfuric, sulfurous, thiosulfuric, tetrathionic, and pentathionic acids are stated.

The theory accounting for the failure of alkaline sulfur mixtures to equal the control efficiency of acid preparations is outlined.

Further studies of the chemical nature of vitamin A, J. C. DRUMMOND and L. C. BAKER (*Biochem. Jour.*, *23 (1929), No. 2, pp. 274–291, fig. 1*).—In this continuation of the investigation noted previously (E. S. R., 55, p. 711), the antimony trichloride color test, under the conditions described by Carr and Price (E. S. R., 56, p. 10), was used almost entirely for the detection and estimation of vitamin A, the authors having concluded that it is a more accurate method of estimating vitamin A than the biological method. The color values are expressed "in the form of the reciprocal of the percentage concentration in grams which gives 10 blue units when 0.2 cc. of the chloroform solution is treated with 2 cc. of a 30 per cent solution of antimony trichloride in chloroform, and the color measured after 30 seconds in a tube of 1 cm. diameter."

An attempt to fractionate on a large scale the unsaponifiable matter from medicinal cod-liver oil having yielded unsatisfactory results, a comparative study was attempted of the unsaponifiable fractions of four sources of vitamin A with the hope of tracing some correlation between vitamin content and chemical characteristics. The materials selected included unsaponifiable fractions from cod-liver oil, sheep-liver fat, Greenland shark-liver oil, and Japanese shark-liver oil.

The unsaponifiable fractions of cod-liver oil and sheep-liver fat decomposed on distillation in high vacuum with considerable loss of vitamin A. Both fractions proved resistant to hydrogenation. Distillation of the unsaponifiable

fractions of both varieties of shark-liver oil brought about comparatively little destruction of the vitamin, but the vitamin formed only a small proportion of the unsaponifiable matter. In all of the concentrates the amount of vitamin A was so minute that in the opinion of the authors direct attempts at the isolation of this vitamin by ordinary chemical methods are of little value. It is concluded that more progress will be made by studying the properties of sterols than by continuing to employ methods of chemical separation.

The detection of vitamin A [trans. title], H. STEUDEL (*Biochem. Ztschr., 207 (1929), No. 4–6, pp. 437–440, fig. 1*).—The author reports negative color reactions with antimony trichloride for many substances in which vitamin A has been identified by biological tests. In his opinion this does not destroy the value of the color reaction as a useful preliminary test for vitamin A. If the test is negative, however, it should be followed by a biological test before the conclusion is drawn that the substance is free from vitamin A.

Factors affecting the accuracy of the quantitative determination of vitamin A, M. P. BURTIS (*Diss., Columbia Univ., New York, 1928, pp. 26+[2]*).—Essentially noted from another source (E. S. R., 60, p. 194).

[The influence of soil composition and treatment on the vitamin B content of food plants] (*New Jersey Stas. Rpt. 1928, pp. 11, 12*).—*Judged on the basis of the growth response of the white rat, the juice of tomatoes supplied a minimum quantity of nitrogen in sand culture was slightly richer than that of sand-culture tomatoes given a larger nitrogen ration.*

The dried cells of Azotobacter were found by F. A. Diakov to supply the vitamin B requirements of white rats. The presence of the vitamin in the liquid portion of the media, after the removal of the organism itself by filtration and the concentration of the filtrate to one-fifth, could not be demonstrated, however. Tentatively it was concluded that Azotobacter does not secrete vitamin B into its culture medium.

Further progress towards the isolation of the antineuritic vitamin (vitamin B) from brewers' yeast, A. SEIDELL (*Jour. Biol. Chem., 82 (1929), No. 3, pp. 633–640*).—A further step in the purification of the antineuritic vitamin from brewers' yeast (E. S. R., 55, p. 609) has been effected by adding an excess of benzoyl chloride to an aqueous solution of the concentrate, made alkaline with sodium carbonate, and extracting the mixture with chloroform. The aqueous solution remaining contains a large amount of sodium chloride and other salts, together with the greater part of the antineuritic vitamin of the concentrate from which it was prepared, but only about one-fourth of the nitrogen originally present. A further removal of the nitrogenous impurities can be effected by pouring the active aqueous solution into about 10 volumes of acetone.

The precipitated salts contained only about half of the nitrogen and practically all of the antineuritic vitamin. The protective dose of the vitamin salts as thus precipitated is given as 60 mg. as compared with 23 mg. for the concentrate as previously prepared, but the nitrogen in the protective dose is only 0.15 mg. as compared with 1.5 in the previous concentrate. The technic for preparing the new fraction is described in detail.

An attempt to separate vitamin B_2 from vitamin B_1 in yeast and a comparison of its properties with those of the antineuritic vitamin B_1, H. CHICK and M. H. ROSCOE (*Biochem. Jour., 23 (1929), No. 3, pp. 504–513*).—In an attempt to separate vitamins B_1 and B_2 (F and G) in yeast, the authors followed, with slight modifications, the procedure of Kinnersley and Peters for obtaining vitamin B_1 free from B_2 (E. S. R., 58, p. 89), and at every step in

the procedure they determined the vitamin B_2 content of the filtrate by the method previously described (E. S. R., 60, p. 690).

It was found that about one-half to three-fourths of the vitamin contained in the original yeast was carried down with the lead acetate precipitate at pH 4.5 to 4.7. At pH 2.6 less than one-half of the vitamin was removed by the lead acetate, and in neutral or slightly alkaline solution the removal was practically complete. The separation of the vitamin from the lead acetate precipitate was effected best by decomposition with hydrogen sulfide at a reaction not less acid than pH 3 (bromophenol blue). The preparation contained more or less vitamin B_1, depending on the reaction at which precipitation with lead acetate had been carried out and the relative amounts of the two vitamins in the original yeast. Although these could be removed by heating, it would be only at the expense of loss of some vitamin B_2.

Other attempts were made to separate the two by solubility in alcohol, dialysis, and the action of ultra-violet light. Although previous observations that vitamin B_1 is soluble and B_2 insoluble in 92 per cent alcohol were confirmed, attempts to separate the two by this method failed through destruction of vitamin B_2 by the alcohol. Attention is called to similar observations by Sherman and Sandels (E. S. R., 61, p. 592). Both of the vitamins dialyzed freely through cellophane. Both were destroyed by ultra-violet light, although vitamin B_2 was destroyed more rapidly than B_1. The conclusion of Hogan and Hunter (E. S. R., 60, p. 293) that vitamin B_1 is resistant to ultra-violet light is consequently not confirmed.

The effect on vitamin B_2 of treatment with nitrous acid, H. Chick (*Biochem. Jour., 23 (1929), No. 3, pp. 514–516*).—The author has been unable to confirm the observation of Levene (E. S. R., 60, p. 690) that the activity of vitamin B_2 (G) is destroyed by the action of nitrous acid. The vitamin B_1 concentrate was prepared from yeast according to the method of Chick and Roscoe noted above, the deamination carried out by the method of Peters (E. S. R., 52, p. 462), and the test for activity before and after deamination by the method of Chick and Roscoe (E. S. R., 60, p. 690). No diminution in the potency of the extract could be observed, the average growth of three rats receiving the material before treatment being 14 gm. and of the three receiving the material after treatment 13.8 gm.

The use of gelatin oleate mixtures for the demonstration of small amounts of calcium, S. Amberg, J. Landsbury, and F. Sawyer (*Jour. Amer. Chem. Soc., 50 (1928), No. 10, pp. 2630–2632*).—Sodium or potassium oleate in gelatin gave a ring reaction with solutions of calcium salts containing as little as 0.0005 mg. of calcium in 1 cc.

The reaction was not found to be absolutely specific for calcium, but it is noted that gelatin may, under certain conditions, be the means of obtaining ring reactions when a stratification of solutions is not possible. Without the stratification brought about by the gelatin method, the reaction of calcium with soluble oleates could be detected only in solutions of about 20 times the concentration demonstrable by the gelatin method.

The oxalate method for separating calcium and magnesium, W. T. Hall (*Jour. Amer. Chem. Soc., 50 (1928), No. 10, pp. 2704–2707*).—For the precipitation of calcium oxalate in the presence of magnesium, an excess of ammonium oxalate, which, if accurately regulated, resulted in the precipitation of pure calcium oxalate, was found necessary. Too large an excess of ammonium oxalate, however, prevented the subsequent complete precipitation of the magnesium as magnesium ammonium phosphate.

A method of detecting minute quantities of aluminum (*Michigan Sta. [Bien.] Rpt. 1927–28, p. 3*).—The examination by means of a new procedure of 90 samples of plant and food materials, in all of which were found appreciable quantities of aluminum, is reported. The figures ranged from 2 parts per million, on the basis of the dry weight, in corn and in wheat, to somewhat more than 100 parts per million in lettuce, in yellow string beans, and in beet tops.

The electrometric titration of manganese by the Volhard method, B. F. Brann and M. H. Clapp (*Jour. Amer. Chem. Soc., 51 (1929), No. 1, pp. 39–41*).—This solution of the problem of the devising of suitable indicator electrodes for the manganese titration is a contribution from the University of Maine.

A procedure ascribed to Foulk and Bawden and consisting of the use of two platinum electrodes subject to a potential difference so small as to be balanced by the reverse electromotive force of polarization, the depolarization of both electrodes with a consequent deflection of the galvanometer having been depended upon for the indication of the end point, was found unsatisfactory, the method having provided no suitable means for the depolarization of the platinum anode. This difficulty was overcome by the use of a silver anode (silver on platinum, or solid silver wire) in the presence of a trace of chloride ion added to the solution. A permanently depolarized anode was thus obtained, together with the further advantage of the development, without the help of an outside source of electromotive force, of a difference of potential between the two electrodes. The first addition of permanganate in excess of that required by the solution titrated depolarized the cathode of this system, causing a full scale deflection, unchanged for about one minute, of a galvanometer having a rated sensitivity of one scale division to the microampere, when this instrument was connected directly to the electrodes. It is noted that although silver wire anodes were used for most of the work, the use either of platinum wire or of platinum foil plated with silver made no apparent difference in the accuracy of the results. The plating required occasional renewal, however.

The data obtained in 18 titrations are tabulated and indicate a high degree of accuracy. The maximum discrepancy shown is +0.08 cc. (10.75 cc. theoretical, 10.83 cc. actually required), the minimum 0.00 cc. in 21.71 cc. required.

Gas production in the making of sauerkraut, L. M. Preuss, W. H. Peterson, and E. B. Fred (*Indus. and Engin. Chem., 20 (1928), No. 11, pp. 1187–1190, figs. 4*).—The gases evolved in the fermentation of sauerkraut were found in this investigation by the Wisconsin Experiment Station to consist almost quantitatively of carbon dioxide, of which the greater part was liberated within 40 to 160 hours after packing. The apparently close relation between the quantity of gas, the acidity, and the bacterial numbers led the authors to attribute the gas production to bacterial activity as distinct from the growth of yeasts or the respiration of plant cells.

The higher temperatures (25 to 28° C.) apparently brought about a fermentation much more rapid than that taking place at the lower temperatures (21 to 24°), and the washing of the cabbage before cutting and packing appeared to have a favorable effect upon the flavor of the sauerkraut.

The Food, Drug, and Insecticide Administration (*U. S. Dept. Agr., Misc. Pub. 48 (1929), pp. 20, figs. 4*).—This publication describes the organization of the Federal Food, Drug, and Insecticide Administration and the operation of its various units dealing, respectively, with the enforcement of the food and drugs, tea, import milk, insecticide, caustic poison, and naval stores acts. Information is also given on the cooperation of the administration with States and cities and with other Federal departments, and on publications which have been issued dealing with the work of the administration.

METEOROLOGY

Climatological data for the United States by sections, [March–April, 1929] (*U. S. Dept. Agr., Weather Bur. Climat. Data, 16 (1929), Nos. 3, pp. [206], pls. 3, figs. 2; 4, pp. [201], pls. 3, figs. 3*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for March and April, 1929.

Meteorological observations, [May–June, 1929], C. I. GUNNESS, L. O. JONES, and D. F. MURPHY (*Massachusetts Sta. Met. Buls. 485–486 (1929), pp. 4 each*).—The usual summaries and notes are given of observations at Amherst, Mass., during May and June, 1929.

Meteorological records for the years 1919 to 1927, inclusive, H. L. PRICE (*Virginia Sta. Rpt. 1920–1927, pp. 155–168*).—Tables are given which summarize in detail observations at Blacksburg, Va., on temperature, precipitation, winds, and cloudiness for the period 1919–1927.

SOILS—FERTILIZERS

Technical studies on the Durham series of soils, W. B. COBB (*North Carolina Sta. Rpt. 1928, p. 42*).—From laboratory studies and field observations it was found that while the subsoils were in some instances very friable and low in clay content, other samples had compact clay subsoils. A microscopic examination of sand grains from the first-mentioned variety of subsoil indicated the presence of from 15 to 20 per cent of such potassic minerals as orthoclase, microcline, and muscovite, but the sands of the second variety of samples "consist almost entirely of quartz showing a more advanced stage of weathering and evidences of the leaching out of potash, and probably also of lime, magnesia, and soda."

Muck soil problems, C. B. WILLIAMS (*North Carolina Sta. Rpt. 1928, pp. 18, 20*).—A pot test on an unproductive muck soil of the effect of various rates of liming with and without the addition of salts of copper and of manganese, showed heavy liming to be essential to the production of soybeans, but failed to demonstrate any effect of either the copper or the manganese added.

The leaching of plant food through the soil, W. B. ELLETT and H. H. HILL (*Virginia Sta. Rpt. 1920–1927, pp. 26–28*).—Lysimeter equipment built in 1922 is described at some length.

With the additional assistance of rain gauges which showed the total quantity of water added by precipitation and permitted also the determination of its content of plant food elements, it was found in the course of three years that there was an average annual gain in 1 acre from atmospheric sources of 3.78 lbs. of nitrogen, 37 lbs. of calcium (calculated as carbonate), and 13.19 lbs. of sulfur. The corresponding average annual losses of the same three elements from 1 acre by leaching were calculated as 46.12, 166.87, and 15.01 lbs., respectively.

Soil microbiology (*New Jersey Stas. Rpt. 1928, pp. 67, 68*).—Work on the composition of plant residues and their microorganismic decomposition in the soil with the formation of humus is summarized in part as follows: The plants used as green manures varied in composition with the nature and with the age of the plant, the older plants showing a lesser content of water-soluble constituents, of nitrogenous compounds, and of minerals, together with increasing proportions of celluloses, hemicelluloses, and lignins, so that with an increase in the age of the plant the rapidity of decomposition and the rate of liberation of nitrogenous and mineral constituents in forms available as plant food were decreased. The varying rates of decomposition of plants of different

composition are considered to be explained readily by considering the composition of these plants, and it is stated that the proportion of nitrogen which will be released as plant food within a given period from residues of any given plant can be computed from the proportion of nitrogen present in the original material and from the nature of the cellulose and lignins.

In a study of the relations between the higher plants and microorganisms, pot-culture experiments were made and the soils examined with respect to the microbial activities there occurring, with results stated to have been as follows: "No pronounced influences during the early development of the plants; most pronounced effects during the degeneration of plants with the disintegration of the root parts; acceleration of microbial production of carbon dioxide appears pronounced as plant growth proceeds; abundance of cells of radiobacter-radicicola types is greatly increased; less significant influences are apparent on the total abundance of bacteria, actinomyces, and fungi; no appreciable increase in the development of nitrogen-fixing organisms was observed."

Caring for the fertility of Illinois soils, L. H. SMITH and F. C. BAUER (*Illinois Sta. Circ. 342* (*1929*), *pp. 20*).—This is a semipopular summary of the "Illinois system of soil fertility." Emphasis is laid upon the means to a permanent and profitable soil productivity through favorable microbiological activity, a suitable soil reaction, and an adequate available plant-food supply. It is noted that adequate drainage, liming wherever necessary, and a good cropping system, including the use of legumes for soil improvement, the provision of active organic matter from plants and animal sources, and the supplying of deficiencies in mineral plant-food elements, are the chief practices necessary to secure the conditions named.

The basic principles of a soil management program, the provision of plant food in a soil management system, and the subject of mixed commercial fertilizers are among the main captions under which the subject is taken up.

Fertilizer experiments on Ontonagon clay (*Michigan Sta.* [*Bien.*] *Rpt. 1927–28, p. 28*).—Where land of this sort was mole drained, fertilized, and limed, the first cutting yielded as much as 3,300 lbs. of dry alfalfa hay from an acre. Even without the draining the yield was 1,900 lbs., but without the lime only about 300 lbs. Finely ground limestone gave much more satisfactory results than did the coarse grade.

Report of the department of soil chemistry and bacteriology, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stas. Rpt. 1928, pp. 316–331*).—Work with soils and fertilizers during the year included the following, continuing earlier work (E. S. R., 59, p. 318):

[*Availability of the nitrogen of sodium nitrate, ammonium sulfate, and dried blood as affected by varying quantities of phosphatic and potassic fertilizers*] (pp. 316–320).—The yields of dry matter and of nitrogen in beets, beet tops, and in the beets and tops taken together are considered.

In the case of the application of the smallest quantity used, both of potassic and of phosphatic fertilizers (the "single portion" of each of these nutrients), the average nitrogen yield in the beets was about 0.[illegible] gm. per cylinder as against 0.64 and 0.68 gm., respectively, in the cases of the application of the double and of the triple portions of the phosphate. When the double or the triple portion of phosphate was used, the nitrogen recovery was highest for the sodium nitrate, and lowest for the ammonium sulfate.

The use of the double portion of potassic fertilizer yielded in nitrogen recoveries distinctly higher than those secured with the single portion, the double portion of the phosphatic fertilizer gave recoveries higher than those either of the single or of the triple, and "in the majority of cases nitrate of soda gave higher recoveries than any of the other nitrogenous materials."

Results in general similar to those above noted are tabulated and briefly discussed in the cases of the beet tops and of the beets and tops taken together.

[*The continuous growing of rye and wheat and of corn with leguminous and with nonleguminous green manure crops, 1927*] (pp. 320–323).—Tabulated data are continued for the 1927 season.

[*Legumes and nonlegumes in soil improvement*] (pp. 323–327).—Earlier work on this subject has been described in the 1925 report (E. S. R., 57, p. 19). The present report continues the record with the data from the 1925 wheat crop and with the timothy and clover yields of 1926 and 1927.

The influence of concentrated fertilizer on crops grown in soils varying in mechanical composition (pp. 327–331).—The variations in soil texture were obtained by the use of mixtures of a heavy Sassafras loam with 0, 20, 40, and 80 per cent of washed white builders' sand, together with a soil consisting of the sand alone. The loam soil had not been fertilized. As fertilizer for the test, a mixture was made from urea, triple superphosphate, and either potassium sulfate or potassium chloride in accordance with the formula, nitrogen as ammonia 16 per cent, available phosphoric acid 18 per cent, and "potash" 16 per cent. This mixture was applied to the cylinders at rates of 0, 100, 250, and 500 lbs. to the acre by broadcasting and working the mixture into the soil to a depth to correspond to field harrowing.

Among the more general conclusions reached are those represented by the statements that "it is possible to use 500 lbs. per acre of a concentrated fertilizer (50 lbs. of plant food to 100 lbs. of material) on a soil that is essentially pure white quartz sand and obtain a yield of dry forage equivalent to over 3 tons per acre"; that the fertilizer, mixed evenly with the soil, "did not appear to injure either the seed or the young plants"; and that "concentrated fertilizer may safely be used for many different crops . . . if care is taken to secure even distribution and then to mix the fertilizer with the soil."

[**Lime and fertilizer tests**] (*New Jersey Stas. Rpt. 1928, pp. 66, 67*).—Soils in cylinders untreated during the 30 years of the experiment on nitrogen availability are reported to be strongly acid and some in very poor physical condition. Cylinders which have had no additions of nitrogen throughout the period of the test were found to contain only one-half as much nitrogen as did some of those "heavily manured and fertilized" through the duration of the test.

Field studies on the availability of nitrogen have yielded the general indication that nitrogen recoveries are lower in the field than in the cylinders. The influence of lime and of fertilizers appeared very much the same, however, in the field as in the cylinders.

It is stated, also, that "some very encouraging results are being obtained from the use of concentrated fertilizers on corn and potatoes."

[**Soil fertility experiments in North Carolina**], C. B. WILLIAMS (*North Carolina Sta. Rpt. 1928, pp. 20, 21, 22, 23, 24–27, 28, 30–33, figs. 2*).—At the Mountain Substation, lime, either alone or with 800 lbs. of a complete fertilizer, seriously injured potatoes by the encouragement of scab. Muriate of potash was slightly superior to the sulfate for potatoes, and more so with wheat and soybeans. Lime and nitrogen used alone were beneficial to wheat, and lime was indispensable for large yields of soybean hay.

When tested as components of a complete fertilizer for a rotation of wheat, red clover, and corn on Toxaway loam, both limed and unlimed, superphosphate, basic slag, rock phosphate, and soft phosphate ranked in order of decreasing effectiveness as given, on the limed plats with wheat. On the unlimed plats with wheat and the limed plats with corn, the order of decreasing effectiveness was basic slag, superphosphate, rock phosphate, and soft phosphate. On the

unlimed plats in corn the basic slag also ranked first, followed by soft phosphate, superphosphate, and rock phosphate.

For corn in 1927 ammonium nitrate and cottonseed meal showed themselves the most effective carriers of nitrogen, followed by urea, sodium nitrate, Leunasalpeter, ammonium sulfate, calcium cyanamide, and sludge.

At the Piedmont Substation in a 4-year rotation on Cecil clay loam with cotton and rye, corn and wheat, wheat and red clover, and red clover, phosphoric acid has shown itself the most marked deficiency of this soil with respect to profitable production of corn, cotton, and wheat, with nitrogen second, and potassium third in order of deficiency. Deficiency in lime, phosphoric acid, and potassium limited the growth of red clover and, in fact, "for the past 8 years, this crop has been a complete failure on the unlimed portion of all plats, except on those receiving the heavier applications of phosphoric acid or potash. On the limed portion of the plats, phosphoric acid has given greater yields of red clover than have the two other plant-food constituents."

Superphosphate was more effective than rock phosphate for corn, wheat, and red clover. On Cecil clay loam at the central station the top-dressing of corn proved of no value. Cotton gave an increase of about 200 lbs. of seed cotton resulting from top-dressing in the first 3 weeks of June, but nothing could be shown to have been gained from later top-dressings. Tests and results of the usual character, concerned with the proportion of organic and inorganic nitrogen and with the comparative effectiveness of various forms of lime, are also described.

At the Upper Coastal Plain Substation cotton on Norfolk sandy loam appeared to be as effectively fertilized by concentrated fertilizers applied with suitable precautions as by low-analysis mixtures. Source of nitrogen and rotation trials are also described.

At the Blackland Substation, a number of sources of phosphoric acid were tried without the production of any significant increases in crop yields. The greatest deficiency appeared to be that of potassium, without which no mixture of phosphatic and nitrogenous fertilizers was profitable in any instance.

General field fertilizer tests with the assistance of individual farmers and in cooperation with the U. S. D. A. Bureau of Chemistry and Soils are described, as are also soil fertility and soil type experiments at the Coastal Plain Substation and a source of lime comparison at the Blackland Substation with results generally favorable to ground limestone.

[**Soil fertility experiments**], T. B. Hutcheson (*Virginia Sta. Rpt. 1920–1927, pp. 123, 124, 131, 132, 133, 134, 136, 139, 140, 141*).—Tests designed to show the variation in required rates of liming with the crop and the soil type are reported. At Williamsburg the crop rotations were (1) corn, wheat, and alfalfa, (2) potatoes, oats, and red clover, and (3) soybeans, rye, and sweetclover, with a liming rate ranging from no lime application to 3,000 lbs. to the acre. No significant increases in the potato yields could be shown to result from liming. The application of 600 lbs. of ground limestone to the acre increased the yield of soybeans, corn, wheat, and rye, but larger applications failed to pay. Oats failed to pay for the treatment. Sweetclover failed entirely if without lime and appeared, according to the results here stated, to require for the best results as much as 2,400 lbs. of ground limestone to the acre, while red clover and alfalfa appeared similarly to have shown the need of lime applications reaching 2,000 lbs. to the acre.

At the Nansemond Substation on Norfolk sandy loam similar tests showed no response with corn, vetch, rye, wheat, and oats, and slight increase with cotton.

For peanuts, soybeans, and potatoes the use of not to exceed 1,200 lbs. of ground limestone per acre proved profitable.

At the Augusta County Substation on Dekalb soil corn, soybeans, and potatoes were little affected by the use of lime. With barley and rye 1,200 lbs. of ground limestone was most effective with wheat, red clover, and alsike clover 1,800 lbs., and with sweetclover 3,000 lbs.

At the Henry County Substation on Cecil clay loam, corn and oats showed no material effects from liming. With cowpeas 1,200 lbs. of ground limestone per acre was most effective, with soybeans and wheat 1,800 lbs., with potatoes, barley, and alsike clover 1,500 lbs., with rye 900 lbs., with red clover and sapling clover 2,000 lbs., and with sweetclover 2,400 lbs.

Reclamation of worn-out and eroded hillsides.—A badly eroded and very poor field, partly covered at the outset of the work with scrub pine and briars, was cleared and the next year was seeded to cowpeas with the use of 300 lbs. of 16 per cent superphosphate to the acre. The peas were plowed under in the fall and followed by rye with 300 lbs. of superphosphate. The rye, in turn, was plowed under, to be followed by a further 300 lbs. of the superphosphate, 2 tons of ground limestone, and a seeding with a grass mixture. The hay crop was cut and a regular rotation of corn, wheat, and grass and clover instituted with the production of from 40 to 50 bu. of corn, 15 to 20 bu. of wheat, and 1.5 tons of hay. Expense and profit data designed to show the profitable practicability of such a reclamation program are given.

Fertilizer and lime experiment.—In the treatment of a corn, wheat, clover rotation at the Henry County Substation, liming was found usually necessary to the securing of a clover stand, without which nitrogen to the extent of 20 lbs. to the acre was needed. The slight increases in yield resulting from additions to the supply of potassium failed to pay for the fertilizer, and applications of sulfur and gypsum gave no increases in crop yields. The most economical results have been obtained when 300 lbs. of 16 per cent superphosphate was applied per acre to the corn and wheat crops and sufficient lime used to insure good crops of clover.

Legume experiment.—Of legumes seeded in the corn at the last working, vetch was found a most effective winter legume with crimson clover second. Cowpeas proved the most effective summer legume. The tests were made at the Henry County Substation.

Influence of fertilizer applications on the nitrate content of the sap (*Michigan Sta.* [*Bien.*] *Rpt. 1927–28, p. 28*).—The soil type and fertilizer treatment were found to have a marked effect upon the nitrate content of the sap of the crop, this nitrate content having been usually lower in a crop grown on a fertile soil than in a crop grown on a poor soil. Sodium nitrate applications raised, and those of phosphatic or potassic fertilizers lowered, the sap nitrate concentration in proportion to the increased growth produced.

Fixation of phosphoric acid, W. B. ELLETT and H. H. HILL (*Virginia Sta. Rpt. 1926–1927, pp. 22–26*).—An attempt was made to ascertain the relative fixation in forms unavailable to plants of soluble phosphates applied to various Virginia soils. The results varied from 95 per cent fixation by Albemarle soils of phosphates as compounds insoluble in N/5 nitric acid and in a citric acid reagent to 40 per cent of such fixation by Norfolk and Valley soils, but successive crops of wheat, oats, and corn grown in greenhouse pots showed the solubility methods to have failed to indicate correctly the phosphoric acid rendered unavailable to plants since the crops mentioned obtained phosphorus no better apparently from superphosphate than from phosphoric acid fixed by calcium carbonate, by iron hydroxide, or by aluminum hydroxide.

The results of outdoor growth in cylinders were the same, in so far as concerned their indication of the failure of the solvent methods to determine the phosphoric acid compounds useless to the plant, as those of the pot tests. "The fixed salts of iron, aluminum, and calcium produced larger yields of wheat when applied to the Albemarle soil than did the more soluble forms of phosphoric acid represented by acid phosphate."

A number of field tests with similar results are also detailed.

Refined methods of making soluble phosphorus determinations (*Michigan Sta.* [*Bien.*] *Rpt. 1927–28, p. 28*).—"Refinement of methods of making determinations of the amount of soluble phosphorus in the soil has made possible large numbers of such tests under widely varying conditions. The results indicate that where this test has revealed one-half part per million or less of water-soluble phosphorus in the soil, phosphoric fertilizers increase the yield of crops; where phosphoric fertilizers have given marked increases in yield one or more parts per million of phosphorus has circulated freely with the soil solution. It appears, therefore, that some soils, owing to their high fixing powers for phosphorus, need much more of this element than do others."

Toxicity of Anaconda phosphate (*Michigan Sta.* [*Bien.*] *Rpt. 1927–28, p. 28*).—Applied in the row with white beans, 10 lbs. per acre of this phosphate was very injurious, probably by reason of the presence of appreciable quantities of compounds of arsenic and of copper. When broadcast, however, the fertilizer could be applied in much larger quantities without toxic effect.

Magnesium deficiency of sandy soil types, C. B. Williams (*North Carolina Sta. Rpt. 1928, pp. 18, 19, fig. 1*).—In liming tests on Norfolk and Durham sandy loams pure crystalline calcite was less effective than a dolomite of similar character. It was inferred that the test indicated a magnesium deficiency in the two soils named.

When adequate quantities of calcium, magnesium, nitrogen, phosphorus, and potassium had been added, indications of other deficiencies appeared. The superiority of potassium sulfate over potassium chloride was interpreted as an indication of sulfur deficiency. Liming with dolomitic limestone developed a manganese deficiency remediable by the application of manganese sulfate.

Fairly reliable indications of three types of soil deficiencies of the two North Carolina soils studied are reported in three apparently distinct chloroses attributed to inadequate supplies in these soils of magnesium, potassium, and manganese, respectively.

AGRICULTURAL BOTANY

Plant physiology (*New Jersey Stas. Rpt. 1928, pp. 58–61*).—A brief report is given of investigations on the available and nonavailable iron in plant tissue fluids as related to the H-ion concentration of the fluids. Analyses of filtrates and solid plant materials in the expressed plant fluids showed that the available iron content was directly related to the pH values of the tissue fluids. Plants having tissue fluids with relatively low pH values had a low iron content, but the iron was practically all in an available form. On the other hand, plants having tissue fluids with pH values near the precipitation of iron had a high total iron content, but most of it was not in a functioning form. It is concluded that the fraction of iron in the plant that is mobile, capable of uniform distribution, and functioning is determined by the pH values of the tissue fluids. It was found further that the H-ion concentration was influenced by light intensity, and the filtrable iron content of the tissue fluids was similarly affected.

Further investigations of the relative rates of absorption by plants of electropositive ammonia and electronegative nitric acid (E. S. R., 59, p. 321) are said to indicate that during the vegetative phase of growth the plants absorb nitrogen, per gram of dry plant material, from culture solutions much more rapidly in the form of electropositive ammonia than in the form of electronegative nitric acid. During the phase of mature development and seed formation the plants absorb nitrogen, per gram of dry plant material, more rapidly in the form of nitric acid than in the form of ammonia when both forms of nitrogen are simultaneously present in the media.

A new method for determining the nitrates and ammonia in relatively small samples of green plant tissues is briefly described.

Studies are reported on the influence of boron on the growth of soybeans, previous investigations having been carried on with broadbeans and Lima beans. An attempt was made to replace boron with other elements of the same group, but it was found that none of them could replace boron in its stimulatory effect on the growth of the plants. The results of the experiments are said to indicate that boron is essential for the complete development of the leguminous plants studied.

Relation of the distribution of certain Compositae to the hydrogen-ion concentration of the soil, J. A. Turner (*Bul. Torrey Bot. Club, 55 (1928), No. 4, pp. 199–213*).—Data which are tabulated from work described for a number of species are said to show that the soil reaction for *Solidago arguta* varied from year to year or from season to season; that *Aster divaricatus, Gnaphalium uliginosum,* and *Ambrosia artemisiaefolia* were greatly reduced in vigor, height, and number of individual plants when growing on soils of high acid or high alkaline reaction; that one in five of the species observed tend to require acidity in their soil reaction; that slightly more than one-fifth of the species observed are widely tolerant of both acid and alkaline soil reaction; and that approximately three-fifths of the species observed tend to require alkalinity.

Soil reaction and plant growth [trans. title], H. U. Oskierski (*Bot. Arch., 20 (1927), No. 1–2, pp. 22–42, fig. 1; Eng. abs., p. 42*).—Respecting studies reported regarding the performance under varied conditions of alkali-sensitive oats and acid-sensitive mustard (*Sinapis alba*), the author considers that, since laboratory results do not correspond with the expectations derived from plant-physiological methods, it would be premature to make a change to the open field. Without repeated control in pot and field trials, it is not possible to prove lime deficiency with certainty.

Influence upon the development of young rice plants of sodium chloride added to a complete solution, F. de Peralta (*Philippine Agr., 15 (1927), No. 8, pp. 471–479*).—In studies described as conducted during March to May, 1925, it was found that sodium chloride in moderate quantity in Espino's best culture solution of the 4-salt type A materially improved the nutritive value of the solution, but that the chlorine ion, not the sodium ion, was beneficial. Potassium chloride was a better source of chlorine than NaCl for this purpose, and NaH_2PO_4 was harmful to the young plants.

The effect of boric acid on the growth of tobacco plants in nutrient solutions, T. R. Swanback (*Plant Physiol., 2 (1927), No. 4, pp. 475–486, figs. 6*).—The behavior of tobacco plants studied when grown in chemically pure water culture solutions indicated that the presence of boron in dilute concentrations is an essential condition to continuous growth. Also the supplying of boron to boron-starved plants in which top growth had already been checked enabled the plant to reestablish the growing point.

Two parts per million of boric acid (0.4 : 1,000,000 of boron) gave optimal growth. At increased concentrations the influence becomes unfavorable, causing slight injury up to 400 : 1,000,000.

The pH value of cell sap of flowers, R. H. Buxton and F. V. Darbishire (*Jour. Roy. Hort. Soc., 52 (1927), No. 1, pp. 46–53, fig. 1*).—Studies are outlined with tabulations, certain results lending support to the theory of selective permeability and selective absorption of spectral wave lengths.

Enzymic relations of pectin, J. J. Willaman (*Minn. Univ., Studies Biol. Sci., No. 6 (1927), pp. 333–341*).—The author reviews, in the order of their usual appearance in plant tissue, pectosinase, pectase, and pectinase, giving a brief account of the status of pectic enzymes.

The question of a rest period for potato tubers [trans. title], K. Snell (*Pflanzenbau [Berlin], 4 (1927), No. 4, pp. 49–51*).—This experimentation indicated that an interruption of the so-called rest period in the case of potato tubers can not be properly spoken of in the same sense as in the case of seeds and woody plants. A hastening of the course of germination occurs only in the case of unripe tubers, and signifies nothing more than a quicker arrival at the stage of ripeness.

Documenta microbiologica: A microphotographic atlas of bacteria, fungi, and protozoa.—I, Bacteria, J. Nowak (*Documenta Microbiologica. Mikrophotographischer Atlas der Bakterien, der Pilze und der Protozoen. I. Teil, Bakterien. Jena: Gustav Fischer, 1927, vol. 1, pp. X+162, pls. 76*).—This work, originally planned to include only the bacteria, was expanded to include other low pathogenic organisms to the extent indicated in the title.

Demonstration of the morphology of certain bacteria and the d'Herelle phenomenon [trans. title], P. Kuhn (*Arch. Schiffs u. Tropen Hyg., 30 (1926), Beiheft 1, pp. 133–143, figs. 10*).—A brief account is given of methods and technic employed in studies, which are outlined with results, on the morphology of certain microorganisms appearing persistently in culture with bacteria, allegedly subsisting at their expense, multiplying by fission, and showing in one stage the phenomenon of conjugation. The name Pettenkoferien was given to the organisms which were demonstrated.

It is thought that an approach to explanation is now possible regarding various data obtained in studies of the d'Herelle phenomenon.

The Kuhn bacteriophage [trans. title], M. Koch (*Bot. Arch., 19 (1927), No. 3–4, pp. 275–313, pl. 1, figs. 3; Eng. abs., pp. 312, 313*).—The author has, from the botanical standpoint, studied according to the method of Kuhn above noted the question of a bacteriophagic organism, starting from the spore formers.

This work is regarded as having shown the existence of an organism capable of producing the d'Herelle phenomenon and to have furnished complete confirmation of the results as regards the "Pettenkoferien" of Kuhn. This organism is said to be related to the Myxomycetes and to pass through a vegetative and a generative cycle. Attempts to culture bacteria without the parasite being present were unsuccessful, as the bacteriophage is more resistant to heat than are the bacteria.

Lignin and humic substances in the decomposition of wood by fungi [trans. title], C. Wehmer (*Ber. Deut. Bot. Gesell., 45 (1927), No. 8, pp. 536–539*).—This is a bibliographical review.

Symbiosis [trans. title], J. Magrou (*Rev. Sci. [Paris], 65 (1927), No. 11, pp. 325–334, figs. 9*).—In the conclusion of a review of the relations involving two typical organisms living in symbiosis, it is claimed that the reciprocal reactions established do not differ fundamentally from those which are set up between parasite and host, although symbiosis may affect profoundly the organization of both the members when subjected to that mode of living.

[Ecological studies], B. W. Wells (*North Carolina Sta. Rpt. 1928, p. 67*).—Progress reports are given on the study of the composition of the vegetation in a shrub bog and on plant successions.

The presence of the shrub *Cyrilla racemiflora* is said to indicate a nondraining soil even when well ditched.

Following fires, especially when there was a deep burning of the peat, the author claims that the most prominent successional plants were *Solidago fistulosa, Erechtites hieracifolium, Andropogon virginicus, A. glaucopsis*, and *Arundinaria arundinaria*. Following drainage no change was noted in five years in the shrub complex along ditches. The author claims that the observation of a grass-sedge area on mineral soil confirmed his conclusion that shrub bog on peat, under fire, never goes into grass-sedge bog, while on mineral soil it does.

GENETICS

Studies on self-sterility.—VIII, Self-sterility allelomorphs, E. M. East and S. H. Yarnell (*Genetics, 14 (1929), No. 5, pp. 455–487*).—The eighth paper of this series (E. S. R., 58, p. 28) reports that 15 allelomorphs of the *S* factor for self-sterility have been isolated from material of *Nicotiana alata grandiflora* and *N. sanderae*. The frequency distribution of the *S* allelomorphs studied suggested that presumably other allelomorphs exist in the material, although probably few in number and rare. The two supposedly distinct types studied formed homogeneous material in so far as the distribution of *S* factors was concerned. It seemed unlikely that there is a second primary locus affecting self-sterility in these forms. However, subsidiary hereditary factors and certain environmental factors have had noticeable effects upon the rapidity of pollen-tube growth in plants characterized by particular *S* factors. The subsidiary factors and changed external conditions were not so effective as to prevent the classification of identical *S* factors by means of cross-sterility tests. A number of the allelomorphs were characterized by different rates of pollen-tube growth after selfing.

Chromosome numbers in the Agropyrons, F. H. Peto (*Nature [London], 124 (1929), No. 3118, pp. 181, 182, fig. 1*).—Counts at the University of Alberta showed the haploid chromosome members to be for *A. griffithsii* 7, *A. richardsonii, A. tenerum*, and *A. cristatum* 14, and *A. repens* and *A. pungens* 21. Several of the wild plants examined did not exhibit normal chromosome behavior. The staining technic is outlined.

Correlated inheritance of glume colour, barbing of awns, and length of rachilla hairs in barley, S. J. Sigfusson (*Sci. Agr., 9 (1929), No. 10, pp. 662–674*).—The behavior in inheritance of glume color, awning, and length of rachilla hairs was studied at the North Dakota Agricultural College into the F_3 of Bearer × Lion barley and Chinese × Lion. Bearer and Chinese are of the Manchurian type and have rough awns, white glumes, and short-haired rachillas, while Lion has black glumes and long-haired rachillas and is classed as a smooth-awned variety, although it has a few short barbs near the tips of the awns.

The factor pairs black v. white glume and long v. short-haired rachilla were simple Mendelian and independent. The pairs black v. white glume and rough v. smooth awn also were assorted independently. The rough-awned condition appeared due to two complementary factors, the factor *R* producing a greater effect than the factor *S*. The factor *R* in the absence of *S* produces the intermediate rough awn. Linkage was noted between long and short-haired rachilla and the main factor for roughness of awn, the crossover value being 30.8 per cent.

The frequency of somatic mutation in variegated pericarp of maize, R. A. Emerson (*Genetics, 14 (1929), No. 5, pp. 488–511*).—Genetic investigations at Cornell University, involving the calico type of variegated pericarp in corn (E. S. R., 37, p. 737) demonstrated that mutations from variegation to self color occur more frequently in the heterozygous (*VW*) than in the homozygous (*VV*) segregates from crosses of variegated (*VV*) with white (*WW*). Different white races appeared to influence differently the mutability of the variegation gene in crosses of variegated with white. White stocks recovered as segregates from heterozygous variegated stocks of low grade were observed to increase the mutability of the variegation gene in crosses less than did the white races tested. Reciprocal crosses of variegated with white and of low with high grade variegation have not been significantly different in grade. Neither low grade nor high grade variegation was dominant in crosses of the two types, the F_1 being intermediate between the parental grades. The author suggests that these facts may best be interpreted by the assumption that there exist modifying genes, linked with the variegation gene, which influence the mutability of the latter.

Potato breeding methods.—II, Selection in inbred lines, F. A. Krantz and A. E. Hutchins (*Minnesota Sta. Tech. Bul. 58 (1929), pp. 23, pls. 3, fig. 1*).—Continued breeding investigations with the potato (E. S. R., 53, p. 425) were centered around selection in inbred lines. Nonfruitfulness in relation to breeding work and ways of avoiding it are discussed briefly.

Inbreeding commercial varieties of potatoes first exposed their heterozygosity, but after the first generation variability was reduced appreciably, and in the third and fourth generations lines began to show uniformity enough to enable recognition of their individuality. There was a general tendency for vigor to be reduced by inbreeding. Two varieties in which lines have been inbred for four or more generations yielded about 40 per cent less than the first inbred generation. Crosses between varieties and between inbred seedlings showed that the loss in yield due to inbreeding could be regained and in many cases reduced by appropriate recombinations. Studies on F_2 and later generations of crosses between inbred lines showed that vigor and yield tended to decline after the F_1 generation. In two crosses between inbred lines carried to the F_2 generation, the difference in yield between the F_1 and the F_2 about equaled that between the first and second inbred generations of a variety.

Results from selfed and crossed progenies suggested that the expression of early maturity depends upon dominant multiple factors. Distinct differences were noted between the seeding progenies of Bliss Triumph, Irish Cobbler, and Early Ohio. Ranked according to the earliness of their seedlings, the order was Bliss Triumph, Irish Cobbler, Early Ohio, Green Mountain, and Lookout Mountain. Rural New Yorker, from behavior in crosses, appeared to be genetically slightly earlier than Green Mountain.

The genetic data from self-pollination and crossing of standard varieties revealed that where varieties differ widely in maturity their seedling progenies will show the same relative difference. However, varieties relatively similar as to maturity, such as Triumph, Cobbler, and Early Ohio may show distinct differences in their genetic constitution in regard to earliness. Evidently it would be desirable in selecting for early maturity to choose first on individual behavior and second on the ability to transmit this character to seedlings. A method consisting of crossing the earliest available fertile seedlings with the early varieties and selecting from later generations derived from these crosses has enabled the isolation of lines in which earliness equal to that of the progeny from the early varieties is combined with relatively high fertility.

nparison in 1927 of the yield of 18 F_1 crosses with the yield of the parents, .56±0.108, suggested the possibility of an important relationship. From a arison of the yield of F_1 crosses with the yield of inbred lines and seedling ies of Triumph, Cobbler, Early Ohio, and Green Mountain, the indications that a high yield probably can be obtained upon recombining the inbred even without selection for high yield. The average yield of 57 inbred was 58 bu. per acre, the seedling families of the four standard varieties u., and of 47 F_1 crosses from lines picked at random 93.2 bu. The most mical procedure appeared to be to determine by actual trial the best binations and to select the best individuals from the highest yielding binations for comparison with the standard varieties to determine value nmercial production.

Solanum hybrid, C. F. CLARK (*Jour. Heredity, 20 (1929), No. 8, pp. 94, fig. 1*).—Examination of the F_1 of *S. fendleri*×*S. chacoense* showed iance of *S. fendleri* in growth habit, color and pubescense of stems, cence of leaflets, shape of calyx lobes, color and shape of corolla and its and the dominance of *S. chacoense* in flavor and size of tuber. It was ossible to obtain the F_2 generation, and the reciprocal cross failed to bear Hybrid vigor was quite evident in the F_1 plants. A very high degree h male and female sterility seems to exist in this hybrid.

ieritance of pubescence in soy beans and its relation to pod color, WOODWORTH and C. VEATCH (*Genetics, 14 (1929), No. 5, pp. 512–518*).—ination of a cross made at the Illinois Experiment Station between a nant glabrous and a recessive glabrous soybean showed that the F_1 was ous and that segregation in the F_2 was in the ratio of 13 glabrous to 3 cent plants. The ratio in F_2 was substantiated by the F_3 results. This ior appeared to be the result of the interaction of two factor pairs, P_1p_1 P_2p_2. P_2 is responsible for pubescence and p_2 for glabrousness. P_1 inhibits om producing pubescence, thus causing glabrousness, while p_1 has no effect . Two color types of pods, dark (L) and light (l) were found in F_2, gation occurring in the ratio of 3 dark to 1 light. The presence or absence bescence was inherited independently of pod color.

ieritance studies in Sevier×Odessa wheat cross, G. STEWART and H. (*Jour. Amer. Soc. Agron., 21 (1929), No. 5, pp. 493–512*).—The F_3 progof a cross between pure lines of Odessa and Sevier wheat were studied at Utah Experiment Station. Sevier is an awned spring wheat with some-compact spike, light bronze chaff, and white grain. Odessa, a winter t, is considered awnless, although bearing tip awns varying in length and head, chaff somewhat darker bronze than in Sevier, and light red ls.

gle factor differences were apparent in regard to awns, spike density, grain color. Definite conclusions did not appear warranted for culm a and number of culms and of spikelets.

FIELD CROPS

gronomic experiments in Hawaii], H. L. CHUNG, J. C. RIPPERTON, and CHTEB (*Hawaii Sta. Rpt. 1928, pp. 13–18, 19–21, figs. 3*).—Varietal tests sweetpotatoes, pigeon peas, sweetclover, and forage grasses, breeding with beans, and miscellaneous trials with ginger, alfalfa, and Pyrethrum viewed as heretofore (E. S. R., 59, p. 626).

continued experiments with edible canna, except in subnormal hills the l number of stalks was found to have little relationship to the ultimate f hill. Averages of a large number of genealogizations showed that after

the third generation there is always a large excess of buds over the number which can develop in a normal hill, suggesting that the vigor of the initial stalk growth rather than the number of stalks is probably paramount in determining the ultimate size of the hill. The size of the hill as harvested at the end of six months was found to decrease with the size of the seed piece below a certain minimum weight; above this minimum, however, there was no certain correlation.

Over a 6-month period at Waimea the total number of stalks remained nearly constant, but the spikes increased regularly, supporting the view that only such proportion of rootstocks develop stalks as is needed to maintain the optimum leaf area required by the plant, the remaining spikes functioning as storage organs. At Waimea variation in the total weight of the various hills appeared to be a function of the total number of rootstocks rather than of the average weight, whereas at the station there was no definite correlation. The number of rootstocks per hill was nearly the same in the two localities, but the average size per rootstock, and hence the total weight, at Waimea was notably greater. Studies over a year showed that very definite cycles of stalk development were apparent at Waimea but not at the station. The large number of spikes at Waimea and practically none at the station are explained by the fact that at Waimea the optimum stalk development is reached after a certain period, while at the station adverse climatic conditions prevent this optimum development; hence the stalk of each new rootstock developed as soon as the rootstock was formed. The scope of field tests with the crop and comments on the defects of the milling process in a starch factory at Waimea are also noted.

Further tests with the viscosity method of determining the strength of a starch showed that the utmost precision is required to secure concordant results. This method was discarded for a method developed to measure the swelling power of the starch. The relatively large effect of electrolytes in depressing the swelling power of edible canna starch as compared with other starches is indicated. The addition of as little as 1 part per million of certain ions to a solution of the swollen granules of edible canna starch causes a very appreciable shrinkage.

[Field crops experiments on the Huntley, Mont., Field Station in 1925 and 1926] (*U. S. Dept. Agr. Circ. 70 (1929), pp. 4–18, 22–27, figs. 3*).—The progress of investigations with field crops under irrigation (E. S. R., 55, p. 132) in cooperation with the Montana Experiment Station is reported on by D. A. Savage. The work included rotation experiments involving alfalfa, sugar beets, potatoes, oats, corn, and wheat; variety tests with corn, field beans, and potatoes; and cultural (including planting tests) with field beans and sugar beets. Experiments with dry land crops, reviewed by A. E. Seamans, comprised crop rotations and tillage tests involving winter and spring wheat, oats, barley, flax, and corn. Much of the above work has been noted in detail from other sources (E. S. R., 60, pp. 636, 729).

[Agronomic experiments in New Jersey], J. G. Lipman and H. B. Sprague (*New Jersey Stas. Rpt. 1928, pp. 27, 28, 29, 30, 307–312*).—Continued investigations (E. S. R., 59, p. 325) reported on included breeding work and varietal trials with corn, wheat, oats, rye, alfalfa, soybeans, red clover, and sweetclover; comparisons of timothy strains and annual hay crops; and various tests already noted or detailed below.

Increased net yields of Green Mountain potatoes resulted from heavier rates of planting, even with as much as 33 bu. of seed per acre. Small sets planted close in the row outyielded large sets at greater distances, although identical quantities of seed were used.

Extensive studies with turf grasses indicated that ammonium sulfate is the best fertilizer for bentgrass turf when vigor of grass and quantities of clover and weeds are considered. Frequent top-dressing, daily close mowing, and daily watering appeared essential for the maintenance of fine turf of the bentgrass at putting green length.

Variegated alfalfas, such as Hardigan, Grimm, LeBeau, and Cossack, were more productive than common, although Hardigan was the only sort promising enough to warrant paying more for seed than Montana common. Common seed from Montana and Kansas was superior to that grown in Provence (France) or Argentina. Common seed evidently should be obtained from a region with a climate as rigorous as that of Kansas.

[Field crops investigations in North Carolina, 1927–28], C. B. WILLIAMS, J. H. BEAUMONT, R. SCHMIDT, and M. E. GARDNER (*North Carolina Sta. Rpt. 1928, pp. 21, 22, 24, 35–40, 75–78*).—Varietal trials with corn, wheat, oats, rye, barley, soybeans, red clover, and small grains and winter legumes for cover crops; tests of strains of potatoes and sweetpotatoes; breeding work with corn, wheat, soybeans, and sweetpotatoes; cultural (including planting) and storage tests with potatoes and sweetpotatoes; a fertilizer trial with sweetpotatoes; and crop rotations are reported on as heretofore (E. S. R., 59, p. 728).

The value of lime and suitable legumes in the crop rotation was demonstrated by the yields of wheat and corn at the Mountain and Piedmont Substations.

Hairy vetch produced more growth than either crimson clover or Austrian Winter field pea on the Coastal Plain Substation and surpassed the latter on the Blackland Substation. It did not winterkill, while the field pea killed badly and was damaged severely by the Ascochyta leaf spot. Hairy vetch gave better results when seeded with a small grain, but it lodged considerably when seeded alone.

Abruzzi rye proved to be more winter hardy than either oats or barley at these substations. The rye did not winterkill on either the Norfolk or the peat soils, barley winterkilled extensively on both types of soil, and oats winterkilled badly on the Norfolk soil and were entirely killed on the peat soil. The rye made by far the best winter growth.

Comparisons during six years on the Mountain and Piedmont Substations indicated that upland is superior to bottom land for wheat, both as to yield and liability to winterkilling. Best returns have come from seedings made on September 15 and October 15.

In potato experiments, whole 2-oz. seed outyielded cut seed, South Dakota Irish Cobbler seed outyielded Maine seed, the closer plantings of Irish Cobbler gave the greater total yield and yield of No. 1 tubers, and under the seasonal and soil conditions sets weighing from 3 to 3.5 oz. outyielded smaller sets.

Selected strains of Porto Rico sweetpotatoes have yielded from 20 to 35 per cent more than common stock. Spacing closer than 12 in. in 3.5-ft. rows did not give appreciable increases in yield of marketable roots. Contrary to previous results, fertilizers containing a high percentage of potassium did not give the higher yields. However, nitrogen derived from mineral nitrates resulted in a substantial yield increase over that derived from animal sources. Storage trials at both Coastal Plain substations showed that sweetpotatoes dug early, i. e., while immature, will keep practically as well as potatoes dug when well matured, if all are properly cured. However, leaving sweetpotatoes in the ground until a few days after a hard frost has killed the vines may result in a heavy loss.

Some of the more outstanding research results in agronomy of the N. C. Agricultural Experiment Station, C. B. WILLIAMS (*North Carolina Sta. Agron.*

Inform. Circ. 27 (1929), pp. [1]+8).—The important findings in agronomic research since the establishment of the station, reviewed in this pamphlet, were obtained in the introduction, improvement and variety, cultural, harvesting, technological, and utilization studies with farm crops, and investigations on plant food sources, soils, soil fertility, fertilizers and amendments, drainage, and farm machinery.

North Carolina agronomy research publications, C. B. WILLIAMS (*North Carolina Sta. Agron. Inform. Circ. 28 (1929), pp. [1]+10*).—The 276 publications listed as published since the founding of the station in the station, extension, State Department of Agriculture and other series deal with the various phases of crop production, improvement, and utilization, soils, fertilizers, and amendments, and farm buildings and equipment.

[Farm crops experiments at the Edgeley, N. Dak., Substation from 1922 to 1928], O. A. THOMPSON (*North Dakota Sta. Bul. 226 (1929), pp. 5, 6, 7–12, 13, 14*).—Experiments continuing those noted earlier (E. S. R., 48, p. 30) but largely discontinued in 1923, 1924, 1925, and 1926 embraced variety tests with wheat, oats, barley, flax, corn, potatoes, field peas, and alfalfa (for hardiness); and cultural trials with field peas.

[Field crops experiments at the Williston, N. Dak., Substation, 1928–29], E. G. SCHOLLANDER (*North Dakota Sta. Bul. 227 (1929), pp. 5–26, figs. 7*).—Variety tests with common and durum spring wheat, oats, barley, flax, corn, alfalfa, sweetclover, field peas, and millet; trials of Triumph strains, comparison of home-grown and imported seed, disinfection for scab and scurf, and improvement work, all with potatoes; crop rotation and crop sequence studies; and a combine harvesting experiment concerned with losses in cereals remaining uncut for some time after maturity are reported as heretofore (E. S. R., 60, p. 34) for the period April 1, 1928, to March 31, 1929.

[Agronomic investigations in Virginia, 1919–1927], T. B. HUTCHESON, T. K. WOLFE, ET AL. (*Virginia Sta. Rpt. 1920–1927, pp. 77–80, 81, 82, 83, 85–87, 88, 117–122, 124–126, 127, 130, 132, 133, 135, 138, 139, 140, 141*).—Experimental activities with field crops reported on from the station and county substations continuing earlier work (E. S. R., 44, p. 732) and not noted heretofore included breeding work with corn, wheat, oats, cotton, potatoes, tobacco, soybeans, cowpeas, and peanuts; varietal trials with corn, wheat, oats, rye, potatoes, tobacco, soybeans, alfalfa, sweetclover, red clover, pasture plants, and cover crops; fertilizer tests with alfalfa and cotton; cultural (including planting tests) with soybeans, sweetclover, and alfalfa; and cutting trials with sweetclover.

Pasture studies at the station have indicated that bluegrass, orchard grass, and white clover is the best combination for the fertile limestone soils of the State, and for the less fertile soils, orchard grass, redtop, sheep fescue, and white clover. White clover enters and greatly improves pastures following applications of limestone and phosphate. It was observed that constant clipping or grazing reduces the yields of dry matter but increases total yields of protein. The protein and mineral contents of pasture grasses was not increased measurably by relatively small applications of fertilizers.

Fertilizers reduced the germination and yield of soybeans when applied with the seed when the soil was dry at planting, whereas such depression did not occur with abundance of soil moisture at planting.

From July 15 to August 15 was found to be the best period for seeding alfalfa in the locality and preferably without a cover crop and at the rate of 20 lbs. of good seed per acre. Cultivation with a spring tooth harrow or alfalfa cultivator early each spring kept out weeds and increased alfalfa yields.

Top-dressings of superphosphate and manure prolonged the stand and also increased yields.

Fertilizer experiments at the James City County Substation indicated that with alfalfa seeded on land rich in organic matter, nitrogen is chiefly beneficial in starting the crop quickly which enables it to endure winter conditions better. The acre rate of phosphoric acid 100 lbs. and potash 50 lbs. has given the most profitable returns.

Worn out old field pasture lands seeded by the Appomattox County Substation to mixtures of tame grasses produced fair to excellent stands, which have persisted strikingly in the face of heavy grazing through long periods of summer drought. Such pastures furnish grazing much earlier in the spring and much later in the fall and are much more palatable to cattle than broom sedge and other native grasses. Soil erosion also has been arrested by the general treatment. Orchard grass, sheep fescue, tall oatgrass, redtop, and lespedeza have been very persistent, and white clover came into all of the plats. Bluegrass probably should not be sown except on the good lands in the section. An area seeded to a pasture mixture and receiving 300 lbs. of superphosphate, when given 1 ton of ground limestone per acre was estimated to have afforded more than twice as much feed to cattle as a similar area not limed, and more species persisted. Abruzzi rye in the rotation of corn, rye (to be grazed the next spring), soybeans for seed or hay, small grain, and clover has given gratifying results for early spring pasturage.

Rotation experiments by the Caroline County Substation showed that corn had more depressing effects upon subsequent crops than had any of the other crops grown. Potatoes depressed the growth of succeeding crops less than did corn or tobacco. Small grains did not appear to differ in their effects, nor did cowpeas and soybeans differ materially in this regard when properly inoculated. Vetch was the most efficient legume in maintaining soil nitrogen. Cultivated crops, following mixed grasses sown after small grains and turned under, yielded much less than after legumes turned under, and very little better than without a cover crop. Potassium deficiency caused a quick depression of tobacco quality which was cumulative, and in corn was shown by blades turning yellow and a weak root system allowing stalks to fall over before mature. Phosphorus deficiency was first evidenced by slow maturity of crops followed by rapidly diminishing yield and quality.

According to fertilizer and liming tests on a grain and grass rotation for bright tobacco farms, carried on by the Pittsylvania County Substation, it is very difficult to grow profitable grain and grass crops on soils of the type (Cecil fine sandy loam) without liming. Lime was advantageous when applied in a rotation containing legumes. Phosphorus led the fertilizer treatments on grains after good legume crops, although on the thinner lands of the section both nitrogen and potassium in addition to phosphorus for grain and grass crops have been profitable until good crops of legumes have been obtained.

Fertilizer tests with cotton by the Nansemond County Substation in cooperation with the U. S. Department of Agriculture indicated that high analysis fertilizers carrying as much as 64 units of plant food per ton may be used safely, provided the fertilizer be applied a week or more before planting and well mixed with the soil. Such fertilizers applied at planting and in direct contact with the seed have reduced stands and retarded early growth.

On the corn, wheat, and hay rotation common to the section the Charlotte County Substation found that the most profitable returns came from land receiving lime and a complete fertilizer, although benefits from potassium were very slight. Nitrogen was less striking in effect as the experiment pro-

gressed. Corn responded very little to lime, whereas wheat and clover seemed to be benefited greatly thereby.

At the Henry County Substation sodium nitrate has been slightly more efficient in increasing yields of clover and timothy hay than has ammonium sulfate. The best date for heavy applications of nitrogenous fertilizers (50 lbs. per acre) has been April 1, and for light applications (from 16 to 32 lbs. per acre) April 15. From 30 to 50 lbs. per acre of nitrogen about April 1 has been most economical.

[Cotton research in North Carolina], C. B. WILLIAMS (*North Carolina Sta. Rpt. 1928, pp. 27, 33–35, fig. 1*).—The F_1 plants from a cross between two strains of cotton homozygous for naked seed and for fuzzy seed, respectively, all bore naked seed, while the F_2 plants segregated in the ratio of 3 to 1, with the naked condition dominant. The F_1 plants from crosses between a strain homozygous for fuzzy-tipped seed and pure naked and pure fuzzy strains indicated that the naked condition of the seed coat is dominant to all grades of fuzziness and that less fuzz is dominant to more fuzz. Varietal trials demonstrated that the varieties producing from 1 to 1$\frac{1}{16}$ in. staple will bring greater money returns per acre than those bearing a shorter staple.

Plants at the Upper Coastal Plain Substation receiving sodium nitrate from 3 to 6 weeks after planting decidedly outyielded those top-dressed later. On both the Upper Coastal Plain and Piedmont Substations early application of fertilizer and ridging usually have given better results than the fresh preparations, particularly during drought at planting time. There has been less fertilizer injury to the seed and seedlings, and the seed bed was more compact and more moist when the season was dry. Better stands generally were obtained on the early prepared plats.

Spacing experiments on the Upper Coastal Plain Substation showed that hills 9 in. apart in 4-ft. rows with 1 to 2 plants per hill outyield and fruit earlier than wider spacings. Cotton chopped a hoe width averaging 2 plants per hill will give 20,000 plants or more per acre, which bearing an average of 5 bolls per plant will produce a bale per acre. Counts on plats with 3 plants per hill revealed that in 50 per cent of the hills only 2 plants developed enough to produce bolls.

The composition of the cottonseed produced in New Mexico, C. W. BOTKIN (*New Mexico Sta. Bul. 175 (1929), pp. 15*).—Analyses of cottonseed of the Acala and other varieties grown in New Mexico in 1925, 1926, and 1927 are set forth in tables. The principal observations in the work have been detailed in the current reports (E. S. R., 57, p. 224; 59, p. 222; 61, p. 219).

Neither a pronounced seasonal variation nor a correlation with the quantity of irrigation water was observed. Immature seed contained less oil and protein than did mature seed. Mature seed of Acala cotton was rather uniform in quality during the 3 years and did not vary materially in oil and protein during the picking season. The seed of Acala cotton was as high in oil and protein as any cotton analyzed, averaging 24.47 and 22.86 per cent, respectively, for the 3 years. Available data from other regions suggest that the New Mexico seed would be among the highest in oil content, above average in protein, and average or less in gossypol.

Oats in the North-Central States, T. R. STANTON and F. A. COFFMAN (*U. S. Dept. Agr., Farmers' Bul. 1581 (1929), pp. II + 28, figs. 20*).—The importance of oats in the North Central group of States is discussed, with information on the climatic, soil, fertility, rotation, cultural, and harvesting requirements of the crop. Varieties suitable for the area are described briefly. The publication

supersedes Farmers' Bulletin 892, entitled Spring Oat Production (E. S. R., 38, p. 340).

Potatoes: Production for certified seed, W. G. COURY (*North Dakota Sta. Circ. 37 (1929), pp. 12, figs. 4*).—The practical suggestions for the production of certified seed potatoes deal with the control of diseases and insects and precautions to be observed in harvesting, storing, and grading.

Ramie, a fiber-yielding plant, L. H. DEWEY (*U. S. Dept. Agr., Misc. Circ. 110 (1929), pp. 12, figs. 4*).—The characteristics, nomenclature, distribution, adaptation, cultural and harvesting requirements, preparation and utilization as a fiber crop, and textile values are described for ramie (*Boehmeria nivea*), sometimes referred to as rameh or rhea.

Cultivated commercially only in China and Japan, the crop has been grown in various other countries but solely for experimental purposes. It grows in a warm temperate climate with abundant rainfall and requires very fertile well-drained soil. China is the only source of supply of ramie fiber, and the importations into the United States are small. The propagation, cultivation, and harvesting of ramie and the preparation of the fiber are all done by hand. Ramie is a remarkably strong fiber adapted to many uses, although not readily spun on machinery designed for other fibers. Degumming corresponds to retting of flax and hemp and is a process in manufacture rather than in the production of ramie.

Fertilizers for rice in Texas, E. B. REYNOLDS and R. H. WYCHE (*Texas Sta. Bul. 398 (1929), pp. 20*).—Fertilizer experiments with rice at Beaumont during the years 1915 to 1928, inclusive, are summarized, with accounts of the history and status of the crop in the State, of the soils and rainfall of the rice district, and a review of fertilizer experiments with rice in the United States.

The maximum average yield, 2,353 lbs. per acre of rice, 553 lbs. more than on unfertilized soil, resulted from application of 100 lbs. of ammonium sulfate per acre. This, the most profitable treatment, averaged $9.65 profit per acre over the period and $4.55 per year during the last 5 years. While additional ammonium sulfate increased the yield somewhat, the increase was not directly proportional to the application.

Superphosphate, 150 lbs. per acre, made larger increases and was more profitable than larger or smaller quantities, averaging an annual acre profit of $4.16. Potash alone was not effective, although with superphosphate or with ammonium sulfate it made significant yield increases. During the years 1924–1928 superphosphate 300 lbs. and potassium sulfate 100 lbs. per acre made the second largest profit, $3.97 annually.

Application of fertilizers 6 weeks after planting resulted in larger average rice yields than did applications at planting, 12 weeks after, or fractional applications. The small increase over treatment all at planting did not appear to justify the expense of fractional applications, and in case ammonium sulfate is used alone it should be applied at planting, since the yield increase from later addition probably would not offset the additional expense. With superphosphate alone or with ammonium sulfate the increase resulting from application 6 weeks after planting was large enough to be profitable.

Varietal standardization of sorgo and the selection of seed, H. B. COWGILL (*U. S. Dept. Agr. Circ. 52 (1929), pp. 23, figs. 16*).—Sixteen of the better known varieties of sorgo are described under the names believed most acceptable, relationships in respect to the form and structure of the head or its parts being followed in the grouping of varieties. The structure of the head and spikelets of sorgo are described and standardization of varietal names is discussed briefly. See also an earlier publication (E. S. R., 55, p. 530).

[Cultural tests with sugar beets in Michigan] (*Michigan Sta.* [*Bien.*] *Rpt. 1927–28, p. 18*).—On soils ranging from a sandy loam to a heavier type of loam, spring plowing to 8- or 10-in. depths yielded more beets than shallower depths, although on a dark, heavy soil (Brookston) 6 in. was as good as 8 or 10 in. Early, May 1 to 5, planting was much more desirable than later dates. Thinning tests indicated that beets should be thinned as soon as the rows show through or at latest within a week or two of that time.

Sweet potato fertilizer, H. H. ZIMMERLEY (*Virginia Truck Sta. Bul. 66 (1929), pp. 699–717, figs. 3*).—The effects of different combinations of nitrogen, potassium, and phosphorus on the yield and quality of sweetpotatoes (Big Stem Jersey) at early and late harvests and in seasons with normal and with subnormal rainfall was studied from 1920 to 1928 on Sassafras sandy loam at the Eastern Shore branch of the station. The percentages of the nutrients in the 15 different mixtures were determined by the triangle method.

A definite interrelation was observed between the amounts of rainfall during the growing season and the relative effectiveness of large quantities of potassium in the fertilizer mixtures. The three more efficient mixtures, containing 15, 12, and 12 per cent of potash, respectively, returned average yields of 119, 111, and 101 bu. of prime sweetpotatoes more than those from the areas producing least during the six seasons of nearly normal rainfall, and average increases of only 26, 30, and 6 bu. during the three dry seasons.

As a measure of the immediate effect of the different combinations, the plats giving the best yields during the first year of the experiment were fertilized with mixtures containing 9, 12, and 15 per cent of potash and not more than 6 per cent of ammonia or phosphoric acid and made increases of 251, 226, and 218 bu. per acre over the unfertilized check plats. Net returns after deducting costs of fertilizer, packages, and harvesting were about $130, $118, and $116 per acre greater than those from untreated areas.

Plats treated with mixtures analyzing 3–3–15 (N–P–K), 6–3–12, and 3–6–12 gave the highest average yields. A high potash to a low phosphoric acid and ammonia plant-food ratio proved most effective. A fairly uniform rise in yield was concurrent with increases in the potash content to the maximum 15 per cent, and a downward trend when the ammonia went over 6 per cent. The quantity of phosphoric acid between 3 and 12 per cent maintained a rather uniform production level.

The percentage of prime sweetpotatoes, based on the total number of enlarged roots, was greatest on the plat receiving a 3–3–15 mixture and lowest on the area treated with a 3–15–3 formula. No correlation was apparent between the percentage composition of the fertilizer used and the losses by rot and shrinkage of the crop in storage. The character of the vine growth was affected more markedly by differences in the nitrogen content than by the phosphorus or potassium content. The higher percentages of nitrogen gave the larger leaves and luxuriant vines.

A mixture furnishing about 30 lbs. of ammonia, 30 lbs. of phosphoric acid, and 150 lbs. of potash is recommended for the Jersey type of sweetpotatoes on moderately fertile soils. To avoid root injury, materials containing large quantities of soluble salts should be applied only after transplanting.

[Tobacco experiments at the Virginia county substations], T. B. HUTCHESON ET AL. (*Virginia Sta. Rpt. 1920–1927, pp. 114, 115, 116, 127, 128, 129, 130, 136, 137, 138*).—Outstanding results, obtained largely in fertilizer trials, are summarized in these pages.

With dark fire-cured tobacco at the Appomattox County Substation a regular increase in yield resulted from each successive addition of potassium, although

the average for 8 years showed that the optimum was about 40 lbs. of potash per acre, since further increases did not pay for the additional fertilizer. A regular increase in crop value and yield came from up to 60 lbs. of phosphoric acid per acre, whereafter both yield and crop value receded. The yield per acre rose for each successive increase in nitrogen, while the crop value increased up to 40 lbs. of ammonium but was conflicting thereafter. The best combination for the soils (Cecil sandy loams and clays) evidently is from 40 to 50 lbs. of ammonia, 60 to 80 lbs. of phosphoric acid, and from 40 to 50 lbs. of potash. Dried blood surpassed either ammonium sulfate or sodium nitrate as a nitrogen carrier, although one-third of the nitrogen from an inorganic source with two-thirds from organic sources has given better results than any single nitrogen carrier. Preliminary tests indicated that supplying half of the potassium from the chloride and half from the sulfate may give better results than from a single source.

Fertilizer experiments involving dark fire-cured tobacco at the Charlotte County Substation showed phosphorus to be the nutrient most needed on soils (Cecil) of the district. Nitrogen and potassium did not pay on tobacco without addition of phosphorus. When a high-grade tobacco fertilizer was applied to tobacco in a rotation of tobacco, wheat, clover, grass, corn, and crimson clover, profitable yields were had without the application of fertilizers to the crops after tobacco. While lime paid with crops other than tobacco and could be used profitably in a rotation when applied a year or two before tobacco, it tended to lower the grade when applied directly to tobacco. A complete fertilizer containing nitrogen 3 per cent, phosphoric acid 6, and potash 3 per cent at from 1,000 to 1,500 lbs. per acre has been effective with dark tobacco. Nitrogen evidently should be obtained partly from sodium nitrate and partly from an organic carrier for best results. Superphosphate and potassium sulfate are indicated as good sources of phosphorus and potassium, respectively. While profitable crops could be produced without potassium, its application with the nitrogen and phosphorus is said to improve the grade of the tobacco. In recent trials dried blood gave the highest returns of the nitrogen carriers, although its superiority was very slight, whereas cottonseed meal and digested garbage tankage were inferior to other sources. An 8–3–3 formula appeared to be the most practical, with 1,000 lbs. per acre giving the most profitable returns.

In fertilizer tests with bright tobacco on Cecil fine sandy loam at the Pittsylvania County Substation, 8–3–3 fertilizer has excelled consistently the 8–2–2 used widely in the section and has been more profitable than other combinations tested. The most profitable acre application for this formula has been 1,200 lbs. Superphosphate has been the best source of phosphoric acid. While potassium chloride usually has given better average yields and acre values than potassium sulfate at this and other county stations, tobacco grown with potassium sulfate had the better burning quality. The best rotations tested have been short rotations omitting legumes, e. g., tobacco, wheat, and rye for green manure. Over four years, the best results in applying fertilizer came from placing all of the material in the row before planting and mixing it thoroughly with the soil. Concentrated formulas, such as 16–6–6, gave similar results as less concentrated materials supplying the same quantity of plant food per acre. Topping plants at from 16 to 20 leaves and pulling leaves as they ripen have been more profitable than cutting and topping as usual.

Relationship of protein content to texture in white wheat (*Michigan Sta. [Bien.] Rpt. 1927–28, pp. 17, 18*).—In the 1925 and 1926 crops of three pure line wheats some of the red vitreous, translucent kernels were found to be distinct mixtures, others indicated by their progenies that they resulted from environ-

mental conditions, and still other red grains gave evidence of natural crossing. It was found that breaking pressure, the force necessary to crush or cut a single kernel, increased with size of grain. Kernels classed as hard had a higher average breaking pressure than those classed as soft, but the hard or soft of one year did not necessarily produce hard or soft kernels, respectively, the next year, suggesting that hard and soft grains within a pure line are due mainly to environment.

Protein content was found to vary, within a variety, with the size of grain, being lower in the smaller kernels. The hard kernels showed a consistently higher protein content than did the soft kernels, but relationship was not apparent between the protein content of one year and the protein content of the progeny nor between protein content and breaking pressure. It was concluded that, within a pure line, environment plays an important part in determining the protein content of the white wheats.

Inspection of agricultural seeds, H. R. Kraybill, O. S. Roberts, R. O. Bitler, R. B. Schulte, E. M. Patt, and P. Balbach (*Indiana Sta. Circ. 161 (1928), pp. 100, fig. 1*).—The purity and germination percentages, the weed-seed content, and for legumes the hard-seed content are tabulated for 1,208 official samples of agricultural seed collected from dealers in Indiana in the period July 1, 1927, to June 30, 1928.

Carbon disulfide for the eradication of perennial weeds, C. F. Rogers and I. Hatfield (*Colorado Sta. Bul. 347 (1929), pp. 23, fig. 13*).—Carbon disulfide applied in holes in the soil of infested areas has successfully killed in a single treatment such perennial weeds as morning-glory and Russian knapweed. Observations in 1928 on 32 tests made in 1927 showed about 80 per cent to give satisfactory results, although no test was less than 60 per cent effective.

Two oz. of liquid carbon disulfide is poured into holes driven 2 ft. apart each way, the holes being 18 in. deep in heavy soils and 12 in. deep in light, coarse, sandy soil. The holes are plugged with soil immediately after application. A simple chemical indicator, described and illustrated, is used to determine the penetration of the gas through the soil.

The current cost of material and of application limits the use of carbon disulfide to kill perennial weeds on small areas or on very valuable and productive land.

HORTICULTURE

[Horticultural investigations at the Hawaii Station], W. T. Pope and H. L. Chung (*Hawaii Sta. Rpt. 1928, pp. 3–13, 18, figs. 6*).—Conforming with previously noted work (E. S. R., 59, p. 632), this report presents information on the culture, propagation, and pollination of various fruits, nuts, and vegetable plants. The side tongue method of grafting again proved most successful with the mango and avocado. Under conditions obtaining at the Tantalus Substation avocado trees set uniformly on practically all varieties. Studies with the Macadamia nut showed considerable variation in growth and fruiting habits, indicating the desirability of asexual propagation. Macadamia seeds planted immediately following full maturity germinated readily. Side tongue and whip grafting succeeded well with this nut. Breadfruit trees were successfully propagated by cuttings taken during the dormant season following the ripening of the fruits. Cuttings introduced from the South Sea Islands met with poor success, due apparently to poor condition. Observations in a grove of 190 papaya trees showed a little over 50 per cent of the dioecious trees to be staminate. Work with coffee consisted primarily of field studies of present methods of culture and handling.

Studies by Chung included an attempt to develop heading varieties of lettuce, but only 2 out of 1,000 hybrids possessed this character, and it is conceded to be too early to determine the constancy of these. Most of the hybrids showed characteristics of both parents, except in relation to heading.

[Experimental work in horticulture at the Huntley Field Station, Montana, 1925 and 1926], D. Hansen, A. E. Seamans, and D. A. Savage (*U. S. Dept. Agr. Circ. 70 (1929), pp. 18–22, fig. 1*).—Yield tests of safflower, a plant deemed of potential value as a source of paint oil, showed possibilities of attaining good yields of seeds. As a result of extensive trials of various trees and shrubs as ornamentals or windbreaks there is presented a list, with notes on behavior and characteristic growth under irrigation

[Horticultural investigations at the New Jersey Stations] (*New Jersey Stas. Rpt. 1928, pp. 44–46, 46–53, 191–214, 220, 223–239, pls. 4, figs. 2*).—The customary annual report (E. S. R., 59, p. 332).

Records taken by A. J. Farley at Westville upon the killing of peach buds from low temperatures occurring January 30, 1928, showed marked varietal differences. Elberta and Elberta-type peaches suffered severe injury. Seedlings with either Greensboro or Dewey as one of their parents showed considerable hardiness. As reported by M. A. Blake, peaches growing at New Brunswick successfully withstood 32° F. while in the pink bud stage. Fruits developing from early-opened Elberta blossoms exposed to cold winds and sleet abscised, while those from later blooms developed. In the case of the Japan Dwarf Blood peach, comparable early flowers set fruits which held. These records and data on other varieties suggest that varieties differ in their temperature requirements during the period of fertilization. Temperatures of from 23 to 27° during the prepink stage caused serious bud injury to apples. Certain varieties, such as Gravenstein, McIntosh, and Rhode Island, suffered severely. Various imperfections of flowers, young fruit, and leaves were observed to follow low temperature injury.

Twig growth studies in the peach previously reported by Blake and Hervey are again noted (E. S. R., 60, p. 741). A comparable study with one-year-old apple trees showed more varietal variation than in the peach. Tables are presented showing the relationship between the number of twigs and the total linear growth in one-year apple trees and for the standard linear growth of one-year Rome trees, both lots being cut back to from 30 to 40 in. when planted.

Pressure tests upon immature peaches grown under high and low nitrogen conditions showed considerably lower resistance in the nitrated fruits. Comparable observations were made on immature Wealthy apples. Variation was observed among the fruits of a single tree, depending on the vegetative condition of the spur. Tabulated results are presented for pressure tests on numerous peach and apple varieties. An apparent relation was observed in the readings on similar varieties of peaches.

Phenological data are given for a large number of fruit and ornamental plants.

A total of 1,285 new seedling peaches, all with J. H. Hale as ovule parent, were obtained by C. H. Connors as a result of 1927 breeding work. The seedlings from the 1927 operations are also listed. Data on the inheritance of pollen sterility, doubleness of blooms, and on pollen selectivity are again discussed (E. S. R., 61, p. 430). New accessions of peach varieties and types are noted.

As reported by J. H. Clark, the Bliss and Boquet strawberries developed by the New York State Station were found highly promising. Other new acces-

sions in small fruits are listed. Strawberry breeding included the use of Aberdeen, Chesapeake, Gandy, Wyona, Lupton, Pearl, Howard 17, and Mastodon as parents. Several crosses were made using the Russell blackberry as ovule parent. The second year yields in the experiment on the source of strawberry plants averaged lower than the first year but showed comparable differences in favor of certain strains. Pressure tests with the strawberry showed a wide varietal range in resistance, from 110 gm. for Kellogg New Beauty to 274 gm. in slightly green Chesapeake fruits.

Biochemical studies conducted by G. T. Nightingale included work with the paper white narcissus (E. S. R., 60, p. 319), and asparagus (E. S. R., 60, p. 741).

Connors, working on the relation of nutrition to calyx splitting in the carnation, found evidence that splitting is associated with a limited external supply of nitrogen and a high carbohydrate and low nitrogen content in the plant. High nitrogen developed succulent stems lacking in substance. Lack of nitrogen promoted larger root systems than did high or low nitrogen. Excessive nitrogen induced sleepiness, a condition of curled petals, poor substance, and low keeping quality. Periods of cloudiness resulted in an accumulation of nitrates and low carbohydrates. Tests with cyclamen seed suggested that germination may be improved by the use of alkaline peat as a cultural medium rather than sand and soil. In peat media potassium permanganate and copper sulfate in weak solutions had some apparently beneficial effects on germination. About 1,500 new carnation seedlings were produced in the 1927–28 season.

Vegetable studies conducted by L. G. Schermerhorn included general fertilizer trials with tomatoes, carrots, celery, asparagus, peppers, sweet corn, and cauliflower. The maximum yield of Marglobe tomatoes, of celery, and of carrots was obtained on the areas fertilized with 800 lbs. of superphosphate (acid phosphate), 200 lbs. of potassium chloride, and 100 lbs. of nitrate of soda per acre. Evidence was secured to suggest that nitrate of soda has a marked influence in increasing vegetable yields. On a basis of a 4-year average, 2,000 lbs. per acre of 4–8–4 (N–P–K) was the best material for fertilizing the spring crop of cauliflower.

Schermerhorn and H. G. Bailey, studying nine varieties of lettuce, found the Joslin strain of White Big Boston to be superior in heading and nonbolting characters. The Marglobe tomato was used extensively in breeding studies.

Studies by W. R. Robbins of the factors influencing the premature heading of cauliflower indicated that a condition of high carbohydrates and low nitrogen encouraged premature heading, suggesting that an abundant supply of nitrogen is desirable. Studies with ethylene gas, 1 part to 1,000 of air, failed to indicate that ethylene hastens the blanching of celery, and, in fact, as a result of the high temperature in the closed compartment indirectly caused injury. With Greater Baltimore and Marglobe tomatoes held at 55–65°, 68–70°, and 70–75°, no significant hastening of the ripening process was observed from the use of ethylene.

The results of spray residue studies (E. S. R., 60, p. 640) are again discussed.

[Horticultural investigations at the North Carolina Station], C. B. Williams, J. H. Beaumont, et al. (*North Carolina Sta. Rpt. 1928, pp. 20, 70–75, 79–81, figs. 4*).—The usual annual report (E. S. R., 59, p. 738).

Liming gave unfavorable results with strawberries, but potash seemed beneficial.

Studies by C. F. Williams of the effect of fertilizer upon the susceptibility of peach trees to winter injury were rendered fruitless by the absence of severe weather. High nitrate trees developed foliage sooner and more rapidly than did trees which had received less nitrogen. This condition is attributed

to large winter reserves, a theory borne out by the results of laboratory analyses. The high nitrogen trees set better and outyielded the others. Injured trees recovered more rapidly on the high nitrogen plats. Trees receiving 4 lbs. of nitrate in addition to the usual treatment gained 0.37 in. in trunk diameter as compared with 0.27 in. for trees with the usual treatment and developed much more vegetatively, as indicated by the average length of terminal growth.

At the Piedmont Substation M. E. Gardner found that heavy pruning of peaches caused but little difference in yield but that the fruit of the lightly thinned trees was better colored and freer from pest injuries. Comparing nitrate and no nitrate treatments, the results were generally in favor of the nitrate.

No evidence was obtained by Williams in fertilizer studies with the dewberry in the Sandhill region to show the value of any particular fertilizer ingredient. In pruning studies cutting off the canes below the ground level apparently helped to control cane blight. The Young dewberry was found promising and was crossed successfully with Lucretia but not with Gardena, Austin Thornless, or itself. Plants of the Coreanus type were crossed with Columbian, Latham, and Ranere.

As determined by R. Schmidt at the Coastal Plain Substation, unlimed strawberries outyielded limed plats, and the berries of the limed plats were smaller. Fertilizers had no apparent influence on the shipping quality of the berries. Tabulation by Gardner on a variety test of strawberries showed Warfield and Premier to be the highest yielders.

Schmidt found that exclusion of insects by screening or dusting did not reduce tipburn in lettuce, and that manganese sulfate used as a fertilizer or sprayed on the plants apparently increased tipburn.

Work with pecans conducted by Schmidt included observations on seedlings and varieties and cracking tests in which the Schley variety was found superior.

Apple pruning studies conducted by Gardner indicated that heading at 3 ft. and training according to the modified leader system is a satisfactory method of developing young trees. Light pruning was consistently better than heavy pruning, both in respect to yield and growth responses.

[Horticultural investigations at the Edgeley Substation, 1922–1928], O. A. Thompson (*North Dakota Sta. Bul. 226 (1929), pp. 12, 13, 14–18, figs. 5*).—Varietal notes are given on various apples, plums, raspberries, lettuce, cabbage, cauliflower, and tomatoes.

Garden and orchard, E. G. Schollander (*North Dakota Sta. Bul. 227 (1929), pp. 26–30, figs. 3*).—A brief summary is presented on the results of varietal and cultural tests with various vegetables and fruits at the Williston Substation.

The North Dakota Earliana tomato again led (E. S. R., 60, p. 41) in production of ripe fruits. A fair crop of plums, crab apples, and compass cherries were secured. The Ohta and Latham raspberries survived the 1927–28 winter without killing of the canes. Green ash, boxelder, Russian olive, and Caragana trees planted as a shelter belt made excellent growth the first summer.

[Horticultural investigations at the Virginia Station], W. B. Ellett, H. H. Hill, F. W. Hofmann, and M. P. Miller (*Virginia Sta. Rpt. 1920–1927, pp. 52–63, 142–148*).—In this report, covering the eight years from July 1, 1919, to June 30, 1927, there is presented a brief review of work in progress and several articles not published elsewhere.

As reported by Hofmann, following statistical analysis of records, a complete fertilizer gave the best returns in orchards at Blacksburg. In the case of Stayman Winesap, nitrate alone or in combination with phosphate or

potash was next. The same situation obtained with Grimes. York Imperial showed the best responses to nitrate in noncultivated plats, nitrate in combination, and complete fertilizer. Stayman Winesap was the only variety to show a significant response to phosphate or potash alone. As a whole, the results were in favor of a balanced N–P–K fertilizer. In a comparable experiment at Crozet, better results as a whole were obtained in the case of Stayman Winesap where nitrate was used with either phosphate or potash or both. In one instance both Winesap and Stayman Winesap gave the best yields with nitrate alone. In the case of York Imperial, higher gains were obtained with nitrate alone than with either phosphate or potash, but the best results were secured with nitrate in combination with phosphate or potash or with both. York Imperial was quite evidently peculiar in respect to its requirements. A complete fertilizer in the proportion of 4–1–3 (N–P–K) is suggested as a basic treatment.

The results of an experiment at Winchester to determine to what extent the biennial fruiting habit of the York Imperial apple can be controlled by applications of nitrate of soda showed lower variability from year to year in nitrated plats in all but one instance, suggesting that nitrate of soda tends to reduce year to year variation in yields. Concerning size of application, 4 lbs. per tree gave a gain of 574 lbs. of fruit per tree, 7 lbs. gave a gain of 734 lbs., and 10 lbs. an 841-lb. gain, with odds of certainty in all cases.

Concerning the relation between growth and yield, the following coefficients of correlation were secured: At Blacksburg Stayman Winesap 0.73, York Imperial 0.71, Winesap 0.59, and all varieties 0.59, and at Crozet the coefficients for the same varieties were 0.61, 0.68, 0.71, and 0.63, respectively. The data for the several experiments are presented in tabular form.

A paper entitled The Removal of Spray Residue from Apples, by Ellett and Miller, is embodied (pp. 142–148) and gives the results of treating sprayed apples with various chemicals, a record being given of the spray program followed and the amount of arsenic present on the fruits. Hydrochloric acid at the strength of 2.5 per cent was found most effective, removing over 90 per cent of the arsenic in 5 minutes at a temperature of 70° F. Higher temperatures resulted in the subsequent darkening of the fruit. All signs of spray residue were removed by this treatment. A 5 per cent solution of sodium hydroxide removed from 80 to 85 per cent of the arsenic from fruits sprayed with arsenate of lead or with arsenate of lead plus Bordeaux. Sodium chloride and sodium carbonate when used in a strength of 4 per cent each in 100 parts of solution were found effective; the time was 10 minutes and the temperature 100°. Sodium hyposulfite proved unsatisfactory. Sprayed apples dipped for 5, 10, 15, and 30 minutes in a 2.5 per cent hydrochloric acid solution and then rinsed, dried, and stored for 112 days in cold chambers, and also sprayed apples dipped in a 5 per cent solution of hydrochloric acid for 5 minutes and stored under like conditions, developed no visible injury and showed no trace of residues. These apples were not treated until December 14, more than two months after harvesting. Sodium hydroxide-treated apples under like storage showed slight shriveling but were not radically different from the checks. In conclusion, the authors point out that mechanical methods of residue removal have not proved satisfactory, and that the chemical solutions offer a feasible means of overcoming the difficulty.

Spinach fertilization with synthetic nitrogen salts, H. H. Zimmerley (*Virginia Truck Sta. Bul. 63 (1928), pp. 645–657, fig. 1*).—When applied in equal quantities in respect to actual nutrients, Calurea, urea, calcium nitrate, and Leunasalpeter all supplied nitrogen in a satisfactory form to promote rapid growth of spinach when used as top-dressing in complete fertilizer combina-

tions. The yields of marketable spinach agreed very closely with those of the control plats fertilized with a mixture of sodium nitrate and ammonium sulfate. On a basis of 100 per cent for the controls the average yields for urea, Leunasalpeter, and calcium nitrate were 98.9, 102.8, and 100.9 per cent, respectively.

It is suggested that the several materials be used with regard to their physiological acidity reaction and that of the soil upon which they are to be applied. On sandy soils it is advised that the mixture should contain at least half of the nitrogen in the soluble organic or ammonia form. Mixing the deliquescent calcium nitrate or Calurea with a neutral drying material facilitated their use, and it was also essential that the superphosphate should be cured and dried.

A physiological study of rooting and callusing in apple and willow, C. F. Swingle (*Jour. Agr. Research* [*U. S.*], *39* (*1929*), *No. 2, pp. 81–128, figs. 17*).—Utilizing as plant material cuttings of the Springdale apple and of *Salix alba*, plants characterized by the development of root primordia in the bark of above-ground portions, the author found in studies in the Laboratory of Plant Physiology, Johns Hopkins University, that temperature, water, and oxygen relations have a definite influence on rooting and callusing tendencies. Cuttings taken in autumn, winter, and spring were tested in darkness at 7 constant temperatures in each of 16 series with constantly flowing gas, the series differing in respect to oxygen and water conditions within the chambers.

In general the results were similar with willow and apple. The favorable temperature range for rooting willow cuttings, from 20 to 33° C., was longer than that for the apple, 24 to 29°. The optimum point, 29° (84.2° F.), was practically the same for both species. The maximum temperature was in the vicinity of 39° for both plants in the presence of adequate oxygen. The minimum temperature for rooting was consistently higher in willow than in apple, and in the case of apple was not affected by any of the water or oxygen conditions employed.

Seasonal influence on rooting was more evident in the apple than in the willow cuttings. Spring cuttings of apple had a lower optimum temperature for rooting than those taken at other seasons and also a broader range. Both rooting and callusing were more active in the apple in early spring, but no direct influence could be established between bud activity and either process. In the apple callusing was more active at slightly higher temperatures than was rooting and with somewhat less water and oxygen supplies than those which favored root formation.

The immersion in water for 48 hours of apple cuttings markedly retarded rooting but was beneficial in the case of the willow. In the apple callusing was retarded by any of the several water treatments. Under favorable conditions callus formation was generally found to be more active at the base of the cutting, suggesting an influence of polarity. The exposure of apple cuttings to oxygen at the pressure of 1 atmosphere did not influence apple rooting but did retard callusing. In the case of the willow when no water treatment was used a large oxygen supply seemed to retard rooting, with some suggestion that minimum temperature may be raised by excess oxygen. Both top and base callusing seemed to have been more affected by excess oxygen than in the apple.

Maturity standards for harvesting Bartlett pears for eastern shipment, F. W. Allen (*California Sta. Bul. 470* (*1929*), *pp. 27, pl. 1, figs. 6*).—Discussing briefly the physical and chemical changes occurring in Bartlett pears incident to ripening, the author reports the results of investigations conducted in cooperation with the U. S. Department of Agriculture in which it was clearly

established that firmness of flesh and color changes offer the only practical indexes to the time of harvesting for eastern shipment. Pears were collected at different localities at frequent intervals prior to and during the commercial season. In general a significant and consistent decrease in firmness of flesh was noted throughout the season. Fruits did not attain best quality when picked before they had softened to the neighborhood of 20 lbs. in the pressure test, varying somewhat according to the district where grown. Rootstocks had an influence on the softening processes. On Japanese roots Bartlett pears were extremely firm and later in ripening than on French pear roots.

Late-picked fruits ripened in from two to three days less time than did early-picked fruits but usually kept longer after ripening and developed higher quality; in fact, fruit of the earliest pickings often failed to ripen normally.

Color changes, as indicated by a chart, a copy of which accompanies the bulletin, were found useful accompaniments to the pressure readings. The amount and rate of softening and of color change was apparently influenced by, or at least associated with, the temperature and humidity of the locality where grown and with soil moisture. In regions where Bartlett pears had very firm to tough texture and were of high color, color was the better index, while in other sections firmness of flesh proved the more satisfactory criterion. The construction and use of the pressure tester and the use of the color chart are discussed.

Directions for grading and packing Illinois peaches, J. W. Lloyd (*Illinois Sta. Circ. 343* (*1929*), *pp. 8*).—This is a revision of Circular 310 (E. S. R., 55, p. 341) bearing the same title, and in a like manner contains practical information on grades, grading, and packing of peaches.

Plum variety test, A. B. Fite and F. Garcia (*New Mexico Sta. Bul. 174* (*1929*), *pp 30, figs. 8*).—Information is presented on the behavior and characteristics of plum varieties based on observations made over a period of years in a test orchard established in 1914. In general, varieties of the Japanese type proved hardy and fruitful, while many of the European varieties succumbed. The few varieties of native plums included in the test were, with the exception of Wild Goose, rather inferior. A list of the more promising varieties includes Beauty, Climax, Formosa, Santa Rosa, Satsuma, and America of the Japanese group, Wild Goose of the native group, and Sugar, Italian Prune, Imperial Epineuse, Giant, Agen, Damson, Standard, and Grand Duke of the European type.

Studies of factors influencing separation of dried prunes into quality grades, E. H. Wiegand and D. E. Bullis (*Oregon Sta. Bul. 252* (*1929*), *pp. 47, figs. 26*).—Believing that the present system of size grading of prunes is inadequate because of failure to take quality into sufficient consideration, the methods of flotation in salt and sugar solutions were studied with a view to developing improved methods.

Working with dried prunes, it was found that regrading into maturity grades was possible, the fruits separated by gravity in the more dense solutions being of better quality. Fruit from the heavier fractions was considerably higher in sugar content and somewhat lower in H-ion concentration. There was considerably more flesh in relation to pit in the fruits from the dense solutions. In large prunes the pit percentage was found quite constant, while it was variable in small-sized fruits.

In the case of freshly gathered prunes the results were even more satisfactory. Ripe prunes were the heaviest and yielded the best product. In fresh fruit the pit percentages of the various fractions were nearly the same, with the heavier fractions showing slightly higher. The acid content in all fractions increased with the decrease in gravity of the fruit. Sugar content of the

flesh of fresh prunes decreased as the moisture content increased. The salt solution of the greatest density used, namely 60° salimeter, separated out the fruits of the most desirable physical characteristics. It was found that fermented and burned fruits could be floated out in boiling water but that infected fruits had to be removed by hand. The chemical examinations of the product obtained by the flotation principle of grading confirmed in every essential the conclusions arrived at by physical and field observations.

[Cranberry investigations], C. S. Beckwith and B. R. Fudge (*New Jersey Stas. Rpt. 1928, pp. 41–43, 164–167, 170–172*).—A further report (E. S. R., 59, p. 335) on studies at the New Jersey Stations.

Cranberries suffered severely from late spring frosts, the 1927 crop being the smallest in 30 years, with the result that fertilizer treatments gave rather indefinite returns. Quick-acting kinds apparently indirectly contributed to frost damage by their stimulation of early growth. Yield records taken in a sanding experiment gave 3,120, 6,760, and 9,200 lbs. per acre for unsanded, sanded in 1925–26, and sanded in 1924–25, respectively. It is believed that the sanded areas were actually warmer on frosty nights.

Water table experiments confined earlier conclusions, namely, the desirability of holding the water level at about 9 in., the maximum yields being obtained on the plat held at from 9 to 12 in. throughout the growing season and on the plat held at from 9 to 11 in. from blooming time onward. Conditions of medium high temperature and abundant light are believed to increase the color of cranberries.

The Young dewberry, J. G. Woodruff (*Georgia Sta. Circ. 86 (1929), pp. 6, figs. 4*).—A description is given of the plants and fruits, with notes on culture, training, and desirability.

Strawberries in Florida: Culture, diseases, and insects, A. N. Brooks, J. R. Watson, and H. Mowry (*Florida Sta. Bul. 204 (1929), pp. 477–523, figs. 14*).—Including information on the results of variety tests, in which the Missionary was supreme, and on the average yields per acre over a 6-year period, a general discussion is presented on strawberry production, taking into consideration planting, source of plants, fertilizers, general culture, packing, grading, and the control of various diseases and insect pests.

The young vineyard, N. L. Partridge (*Michigan Sta. Circ. 124 (1929), pp. 16, figs. 7*).—General information is presented on the planting and care of the young vineyard, discussing such points as the location, soils, prevention of erosion, propagation, methods of planting, pruning, general care, and varieties.

The use of sulfur dioxide in shipping grapes, H. E. Jacob (*California Sta. Bul. 471 (1929), pp. 24, figs. 7*).—This is a further discussion of the principles (E. S. R., 53, p. 744) and practices involved in the treatment of grapes with sulfur dioxide to prevent the development of molds and other decay-causing organisms during transit or storage. The treatment originally applied to commercial practice in 1924 had developed in 1928 to the extent that over 10,000 carloads of grapes were treated. Specifications are given for the materials employed in the construction of sulfur dioxide generators as used at the university farm, with notes on operation. Information is also presented on the use of liquid sulfur dioxide.

In concluding, precautionary measures necessary to the successful use of the gas are discussed and notes presented on the potential benefits to be derived from sulfur dioxide treatment. It is emphasized that sulfur dioxide can not improve the condition or quality of fruits but is simply a means of preservation during the period from harvest to marketing or use.

Azaleas and rhododendrons from seed, B. Y. Morrison (*U. S. Dept. Agr. Circ. 68 (1929), pp. 8, figs. 3*).—Information of a general nature is presented on

the preparation of the soil, planting and watering, transplanting, shading, and the results with various species.

Ornamental plants for the home grounds, M. M. PARKER (*Virginia Truck Sta. Bul. 62 (1928), pp. 631–644, figs. 3*).—A general discussion is presented upon the propagation of shrubs, roses, herbaceous perennials, and evergreens, with supplementary notes on planting plans and practices, pruning, etc.

Directory of field activities of the Plant Quarantine and Control Administration (*U. S. Dept. Agr., Misc. Pub. 47 (1929), pp. 50, pl. 1*).—A small handbook of general information.

FORESTRY

[Forestry investigations at the Michigan Station] (*Michigan Sta. [Bien.] Rpt. 1927–28, p. 20*).—Working in conjunction with the Lake States Forest Experiment Station of the U. S. D. A. Forest Service, it was found that the scrub oak lands of northern Michigan, comprising over a million acres, have good prospects for profitable forestry if properly protected from fire. It was estimated that, on the basis of mature yields, oak should return about 4 per cent and white and Norway pines about 5.5 per cent annually on the investment in land. The value of the forests as a wild life cover is deemed equal at least to that of the timber. That balsam fir and spruce may be profitably grown as sources of pulpwood is suggested.

Black locust in Pennsylvania, A. C. MCINTYRE (*Pennsylvania Sta. Bul. 236 (1929), pp. 20, figs. 12*).—In addition to a general discussion on the silvicultural aspects, such as propagation, planting, thinning, harvesting, renewal by sprouts and suckers, etc., data are presented on the growth and yield of black locust plantations located on 21 different sites. The average tree at 25 years would approximate 6 in. D. B. H. and 35.8 ft. in height. Estimates indicated at 40 years of age a potential production of 1,119 first class, 537 second class, and 178 third class posts.

Tables for determining the volume of black spruce, R. M. BROWN (*Minnesota Sta. Tech. Bul. 57 (1929), pp. 16, figs. 2*).—Based on measurements taken during the harvesting of a 100- to 110-year-old pure black spruce stand at the Cloquet Forest Experiment Station, volume tables are presented, together with suggestions concerning the precautions which should be taken in applying these volume tables to other stands. Suggestions are given for correcting the tables when the variation exceeds the accepted limits of error.

A cone and seed study of the mountain pine (Pinus pungens Lambert), A. C. MCINTYRE (*Amer. Jour. Bot., 16 (1929), No. 6, pp. 402–406, pl. 1*).—Believing that mountain pine may become of silvicultural importance because of its ability to crowd out better species, the author studied the fruiting and growing habits of the tree and some of the characteristics of the seed. A temperature of at least 90° F. was required to open the cones, thus explaining why cones on shaded limbs may endure for years without opening. An examination of over 200 cones collected from different trees showed no seed in the lower third of any of the cones. In the cones of a single tree there was found no relation between the length or weight of the cone and the number or viability of the seeds. More seeds were borne singly than doubly. The age of trees had no effect on viability of seed or size of cones. Viability tests by inspection and by actual growth checked closely.

Modification of western yellow pine root systems by fertilizing the soil at different depths in the nursery, W. G. WAHLENBERG (*Jour. Agr. Research [U. S.], 39 (1929), No. 2, pp. 137–146, figs. 3*).—This paper, a contribution from

the U. S. D. A. Forest Service, discusses the results of nursery experiments at the Savenac nursery, Montana, in which the soil of seed beds was modified to a depth of 10 in. by concentrating the fertilizer, sheep manure, in a 2-in. soil layer located at different levels. Western yellow pine seedlings were grown as plant material.

After 2 years' growth the young plants were washed out of the soil and measurements made upon the roots and tops, after which representative lots were planted in the field. In respect to the frequency of roots in relation to the depth of the fertilizer, it was found that seedlings in the beds in which the fertilizer was placed at from 6 to 8 in., and 8 to 10 in. below the surface had the most roots in the deeper layers. The maximum root frequencies for no fertilizer, uniformly distributed fertilizer, 2- to 4-in. layer, 4- to 6-in. layer, 6- to 8-in. layer, and 8- to 10-in. layer were in the 5-, 5-, 5-, 6-, 8-, and 10-in. levels respectively. The deeply fertilized plants had also made the largest top growth as indicated by height.

In the field tests on seedlings root-pruned to 8 in. before planting there was found materially greater survival in stock from the beds in which the fertilizer had been deeply placed. In concluding, it is pointed out that the results were obtained over a somewhat impervious subsoil which may have prevented any considerable leaching of nutrients.

DISEASES OF PLANTS

Lectures on plant pathology and physiology in relation to man (*Philadelphia and London: W. B. Saunders Co., 1928, pp. 11–207, figs. 16*).—This is a series of lectures given at the Mayo Foundation, the Universities of Minnesota, Iowa, and Wisconsin, the Des Moines Academy of Medicine, Iowa, and the Iowa State College during 1926–27. These lectures, which, with an index, cover important aspects of recent investigation in the field of plant pathology and physiology, and which were given by workers chosen because of their original research work in the fields concerned, deal, respectively, with Filterable Viruses, by L. O. Kunkel (pp. 17–32); Ecology and Human Affairs, by H. C. Cowles (pp. 33–41); Some Aspects of the Fusarium Problem, by G. H. Coons (pp. 43–92); Racial Specialization in Plant Disease Fungi, by E. C. Stakman (pp. 93–150); The Relation of Plant Pathology to Human Affairs, by H. H. Whetzel (pp. 151–178); and Some Aspects of Cellular Physiology, by W. J. V. Osterhout (pp. 179–197).

Plant pathology (*New Jersey Stas. Rpt. 1928, pp. 53–57*).—Summary accounts are here given of studies on plant diseases and their control, more detailed reports of most of the investigations being noted elsewhere.

Of the results of the investigations not so reported, fruit spot of apple is said to have been controlled by applications of Bordeaux mixture or of colloidal copper. Copper dusts were somewhat less efficient, and sulfur in any form proved unsatisfactory. The use of copper fungicides resulted in considerable russeting of the fruit.

For the control of anthracnose of black raspberries, a dormant spray with lime sulfur 1–10 gave better results than a 1–20 spray. A preblossom spray with Bordeaux mixture gave better results than lime sulfur. Applying Bordeaux mixture after harvest appeared to be without beneficial results.

Studies of the effect of environmental factors on Rhizoctonia of potatoes are said to indicate that any factor or combination of factors, such as low temperature, soil moisture, depth of planting, etc., that retarded the emergence of the plants from the soil favored severe infection.

It is claimed that organic mercury compounds can be used as dusts at the rate of from 2 to 4 oz. per bushel for the control of corn root rots without injury, but when used in liquid form at concentrations greater than 0.75 per cent, injury resulted. With nearly disease-free seed corn, the treatments were without effect. With diseased seed, the treatments gave favorable results.

Investigations of tomato wilt are said to have shown no material differences in the water requirements of healthy and diseased plants. The growth of *Fusarium lycopersici* on culture media produced a toxic material that caused wilting, and the toxicity was increased with the age and type of culture media used, being influenced by the source of nitrogen used and the reaction of the medium.

Report of the department of plant pathology, W. H. MARTIN ET AL. (*New Jersey Stas. Rpt. 1928, pp. 241–278, pl. 1, fig. 1*).—Detailed accounts are given of investigations carried on by the department of plant pathology in addition to those noted on page 741.

New Jersey plant diseases, W. H. Martin (pp. 241–253).—Annotated lists are given of the plant diseases observed during the season covered by the report.

Potato studies, W. H. Martin (pp. 253–257).—A spraying experiment is reported, in which a comparison was made of Bordeaux mixture, a proprietary compound containing 22 per cent metallic copper, copper-lime dust, and colloidal copper. The results are inconclusive, as diseases were not prevalent, and leafhopper injury was not severe.

A report is given of 5 years' testing of New Jersey grown certified seed potatoes to determine the relation of virus diseases to yield. An average decrease in yield of 20.1 per cent was reported in plats the seed tubers of which were affected to the extent of 15 per cent or more with virus diseases.

Tests were made to determine the relative efficiency of organic mercury compounds for the control of seed-borne scab and Rhizoctonia. Instantaneous dips at various strengths were said to be as efficient as the standard corrosive sublimate treatment.

An experiment on the value of adding organic mercury compounds to fertilizers for the control of scab showed that the use of Semesan applied to fertilizers at the rate of 30, 60, and 90 lbs. per acre reduced scab in plats the soil of which was badly infested with scab. Retarded growth was observed early in the season in proportion to the amount of the compound used, and this difference continued to midsummer where the largest quantity of the mercury compound was used. The 60- and 90-lb. applications of Semesan reduced the total yields by 29.3 and 46.1 bu. per acre, respectively, as compared with the check plats. On the check plats only 5.6 per cent of the crop was clean as compared with 41.5, 62.7, and 69.3 per cent for the plats receiving the organic mercury treatments.

Sweetpotato disease control studies, W. H. Martin (pp. 257–262).—Strain and variety tests of sweetpotatoes were again made to determine their resistance to stem rot. The results of this test were in agreement with those previously noted (E. S. R., 59, p. 338). Plantings of 1, 2, and 3 plants per hill were repeated, and where root rot was severe, planting 2 or 3 plants in a hill was found to more than repay the extra cost of the plants.

Dipping sweetpotato sprouts in organic mercury compounds for the control of stem rot proved satisfactory, as the treated sprouts gave an increase in the number of clean hills. Reduced infection by black rot and scurf followed similar treatments. Dipping clean sprouts in organic mercury compounds was found to be of little value when the sprouts were planted in clean soil. The treatment of seed sweetpotatoes with corrosive sublimate and organic mercury

compounds reduced the amount of black rot and scurf infection about equally, and all sprouts were freer from disease than where untreated sweetpotatoes were used.

Apple scab studies, W. H. Martin and E. S. Clark (pp. 262–267).—Additional data are given on the relation of ascospore discharge to rainfall. Spraying experiments are said to have shown the desirability of delayed dormant and prepink applications for the control of scab.

Effect of soil reaction on Verticillium wilt of eggplant, C. M. Haenseler (pp. 267–273).—Laboratory studies are said to have shown that the growth range of *V. alboatrum* was influenced by variations in the pH value of the medium. The best growth took place at pH 6.0 to 8.0, and there was little growth of the fungus below pH 4.0. Acting on this information, experiments were conducted with eggplants grown in infested soil to which lime and sulfur were added. In a greenhouse test large applications of sulfur prevented wilt infection in an artificially inoculated soil, but the addition of lime in quantities sufficient to give a soil reaction of pH 6.5 to 7.0 increased the severity of the disease. The application of sulfur in quantities sufficient to give a soil reaction of pH 4.2 to 5.0 resulted in a gradual decrease in the severity of the disease over a 4-year period. No injury was observed to the eggplants from relatively high soil acidity. The author does not consider artificial soil acidification promising for the commercial control of eggplant wilt on heavily infested soil, but the application of lime preliminary to planting eggplants is not to be recommended. Heavy green manuring was found to apparently retard the development of eggplant wilt and consequently increased growth and yield.

Reduction in yield of peas due to root rot caused by Aphanomyces euteiches, C. M. Haenseler (pp. 273–275).—Greenhouse experiments showed a reduction in the height and dry weight of Alaska peas when infected with *A. euteiches*. In field experiments inoculation reduced the yield of seed by 20.4 per cent and of straw by 21.3 per cent. The reduction in dry weight was greater than the reduced size or difference in the appearance of the plants, and it is considered that root rot may be causing much greater damage than is suspected in those fields where peas show a good general appearance in spite of infection.

Diseases of ornamental plants, R. P. White (pp. 275–278).—A report is given of corm treatments for the control of hard rot of gladiolus caused by *Septoria gladioli*. Lots treated with corrosive sublimate or corrosive sublimate to which 1 per cent hydrochloric acid was added gave good control and produced the highest number of cormels. Some of the treatments reduced the number of blooms, and all delayed flowering for from 4 to 9 days.

Drenching soil with formaldehyde after the bulbs were planted gave the most satisfactory control of tulip fire caused by *Botrytis tulipae*. Bulb treatment in addition to the soil drench did not increase the control.

Studies of rhododendron diseases are said to show that *Pestalozzia macrotricha* is a secondary parasite, the primary infection being due to an organism closely related to Phytophthora.

A disease of rhododendron seedlings caused by *Botrytis* sp. was controlled with Bordeaux mixture combined with the destruction of diseased plants.

A number of other diseases of rhodendron are under observation.

In studies of the pathogenicity of various species of Pestalozzia isolated from various hosts, all the forms on coniferous plants were found to be weak parasites. Other species are said to have given negative results when inoculated on uninjured healthy tissues.

For the control of molds on roses in storage, the author recommends ventilation of the storage chamber and control of black spot and canker-producing

fungi in the field. Dipping rosebushes in fungicides after the sweating period and before trenching is recommended for the control of mold caused by *B. cinerea*.

A type of chlorosis of rose is described that is said to be quite distinct from that caused by malnutrition or by the presence of insects.

Division of plant pathology (*North Carolina Sta. Rpt. 1928, pp. 59–67*).—Summary accounts are given of the year's investigations in plant diseases.

Soybean diseases, S. G. Lehman (pp. 59–61).—In continuation of studies on the frog-eye leaf spot of soybeans (E. S. R., 59, p. 849), the author reports that plowing under the leaves and stems of the plant destroyed the fungus. Seed treatments with fungicides for the control of the disease did not give satisfactory results. The fungus is believed to penetrate the seed coats and thus it is carried over from season to season. Plants grown from 2-year-old seed were much less affected than those from 1-year-old seed, indicating that to some extent at least the fungus dies within the seed during prolonged storage.

Seed treatment with several fungicides reduced mildew on the leaves of soybeans.

No fungicide was found to be satisfactory as a seed treatment for the control of bacterial pustule of soybeans, although early in the season there appeared to be less disease on treated than on untreated rows. By the end of the season 95 per cent of the leaves on the treated plants were affected. Experiments are said to indicate that the organism can survive in decaying leaves and thus become a source of infection. Considerable differences were noted in the susceptibility of varieties of soybeans to bacterial pustule, the variety Columbia being practically immune.

Cottonseed treatments, S. G. Lehman (pp. 61, 62).—Stands of early planted cotton are said to be subject to reduction due to attacks of the anthracnose and sore shin fungi. Encouraging results are said to have been obtained in experiments in treating seed by dusting them before planting with corrosive sublimate, copper carbonate, formaldehyde, and several proprietary compounds. The average increase of stand in all treated varieties was 146 per cent. It is believed that the use of these disinfecting dusts on cottonseed will in many cases give sufficient protection to enable the grower to plant his seed from a week to 10 days earlier than would otherwise be safe.

Wheat rust, S. G. Lehman (p. 62).—Tests were made of 150 varieties and selections of wheats to determine their resistance to wheat rust, and while few data were obtained on rust resistance due to the late appearance of the rust, evidence was secured that is said to indicate the greater resistance to winter injury by some crosses between the commonly grown varieties and some of the more hardy western varieties which possess relatively high resistance to leaf and stem rust. Dusting with sulfur controlled rust, and two applications, April 30 and May 7, gave as good results as more frequent applications.

Sweetpotato diseases, R. F. Poole (pp. 63–65).—Studies in continuation of those previously reported on storage rots of sweetpotatoes (E. S. R., 59, p. 749) are said to have shown that black, soft, and surface rots were reduced by applications of lime or Bordeaux mixture in liquid or dust form without any shrinkage or surface injury to the sweetpotatoes. To be effective, the application should be made immediately after harvest.

Additional data are given on varietal resistance to *Fusarium batatatis*, and it is claimed that those varieties which show the greatest sprouting activity and quickest response to field growth are also the most resistant to stem rot. The fungus was found to live over and spread in storage in the small rootlets and the ends of the sweetpotato. Carbohydrates were found essential for the

growth of the fungus. It is claimed that sweetpotatoes were more resistant to *F. oxysporum* when grown on light sandy soils than on heavy ones. The application of fertilizers did not affect the time of appearance or severity of diseases caused by *Ceratostomella fimbriatum*, *Rhizopus nigricans*, and *Monilochaetes infuscans*, but the use of the fertilizers increased the yield.

Field experiments are said to confirm laboratory investigations that indicated that *F. batatatis* could be controlled by dipping or dusting the roots and stems in liquid or dust Bordeaux mixture.

Disinfection studies for the control of scurf (*M. infuscans*) showed that Bordeaux mixture and monohydrated copper-lime dust reduced the disease without retarding sprouting. A number of other fungicides tested either did not control the disease or retarded sprouting. Cutting out infected areas was found to control the disease without retarding sprouting.

Dewberry disease studies, R. F. Poole (pp. 66, 67).—Spraying with a 4–4–50 Bordeaux mixture was found to reduce defoliation caused by *Cercospora rubi*, but there was little difference in yield between the sprayed and unsprayed plants. Anthracnose was controlled by spraying with Bordeaux mixture three weeks before harvest, but an undesirable deposit was left on the fruit.

Blighting of canes due to *Coniothyrium fuckelii* was found to be very important. Infection is said to occur soon after the pruning of the plants in July, and the disease appeared to be more severe on plants pruned well above the ground than when pruned below the surface of the soil.

Root rot caused by *Collybia dryophila* was found to be disseminated on plant sets, and treating them with Bordeaux mixture and other fungicides caused injury. Some evidence was found that is believed to indicate individual variation in plants in regard to resistance to root rot.

Progress and results of investigations in plant pathology, F. D. Fromme (*Virginia Sta. Rpt. 1920–1927, pp. 35–45*).—A condensed account is given of the results of experimental work on plant diseases conducted at the station during the period from July 1, 1919, to June 30, 1927. Detailed accounts of the investigations have been previously noted.

Relation of husk covering to smut of corn ears. C. H. Kyle (*U. S. Dept. Agr., Tech. Bul 120 (1929), pp. 8, pls. 2*).—The results are given of a study of the relationship between husk covering and the occurrence of ear smut of corn.

The data are said to indicate that strains of corn obtained by selection within self-fertilized lines differ widely in their ability to produce, in their crosses with other selfed lines, husks that will tightly inclose the ears. A negative correlation was found between the number of husk-protected ears and the number of smutted ears.

Seven self-fertilized corn lines with established differences in husk protection were used in the crossing experiments, from which it seemed that intermediate inheritance of the husk complex in combination with variable ear size gave the resulting husk protection. All the ears which were tightly inclosed by husks were smut free. The relative sizes of husks and ears were found to vary with environment, and this caused fluctuation in the proportion of husk-protected ears for different conditions. Environmental effect was found to be slight, however, in crosses that had the greatest average proportion of husks to the size of the ears.

Cotton root-rot investigations in Arizona, C. J. King and H. F. Loomis (*Jour. Agr. Research [U. S.], 39 (1929), No. 3, pp. 199–221, figs. 17*).—In continuation of previous studies (E. S. R., 54, p. 846) the authors give a report on additional investigations of the fungus *Phymatotrichum omnivorum*, the cause of cotton root rot, and they suggest means for its control.

It is claimed that the extension of infection into new areas can be effectively controlled by treating the soil with solutions of formaldehyde and cresylic acid. Experiments with organic manures applied in furrows to plats continuously cropped to cotton indicate that this treatment is effective in reducing the extent of infection, in delaying the appearance of the disease, and in retarding its injury to the plants. The manured plats also serve as effective barriers in restricting or retarding the advance of the mycelium of the fungus from adjacent untreated areas. Under Arizona conditions it was found that the fungus was capable of passing under an open trench 20 in. deep which was dug in advance of a ring of dying alfalfa plants.

The authors confirmed the occurrence of conidial mats in areas where no dead plants were evident, and there appeared to be a relationship between these mats and buried fragments of decaying roots.

Attempts at inoculating healthy cotton plants in fields where no root rot had previously appeared were successful. Only a few of the plants were killed, probably due to the lateness of the season. Efforts to transfer the infection to plants growing in tanks were unsuccessful.

From its ability to grow on dead roots, the fungus is believed to exist in nature as a saprophyte, and it may be able to live in the soil in the absence of live root tissues.

Occurrence of the zonate-eyespot fungus Helminthosporium giganteum on some additional grasses, C. DRECHSLER (*Jour. Agr. Research [U. S.], 39 (1929), No. 2, pp. 129–135, pls. 6*).—In continuation of a report on the occurrence of *H. giganteum* on grasses (E. S. R., 60, p. 446), the author records its abundant occurrence on three additional species and its presence with little or no injury on eight other species.

[Some potato diseases and their control] (*Michigan Sta. [Bien.] Rpt. 1927–28, pp. 16, 17*).—Hollow heart of potatoes (E. S. R., 57, p. 544) is said to be more common when the August rainfall is above normal. Wide spacing and small seed pieces appear to favor the trouble.

Bordeaux mixture and monohydrated copper-lime dust treatments are said to have controlled leafhoppers and early blight of potatoes, with accompanying increase in yield. Bordeaux mixture sprays increased yields at a lower cost than did the dusts.

Fusarium wilt of tomato in Virginia, F. P. MCWHORTER and M. M. PARKER (*Virginia Truck Sta. Bul. 64 (1928), pp. 661–674, figs. 2*).—A description is given of the Fusarium wilt of tomatoes, with suggestions for its control.

Tests were made of several varieties of tomatoes to determine their resistance to wilt. Both the Marglobe and Invincible varieties proved more or less superior to Stone in eight widely separated localities. From observations and as a result of the experiments, the authors conclude that the variety Marglobe is the most desirable commercial one available for Virginia farms where Fusarium wilt has caused trouble.

Chemical injury to watermelons in transit, W. W. GILBERT and F. C. MEIER (*U. S. Dept. Agr. Circ. 74 (1929), pp. 10, figs. 8*).—The results are given of experiments in shipping tests with watermelons made to determine whether certain chemicals, including fertilizer materials, left as residues on the walls and floors of box freight cars can cause injury to melons.

Of 10 chemicals used, common salt, nitrate of soda, sulfate of ammonia, sulfate of potash, muriate of potash, superphosphate, a mixed fertilizer, and a watermelon fertilizer were found capable of producing injury under certain conditions. Two general types of injury were observed, a sunken, corroded, leathery appearance produced by superphosphate; and a browning, water-soaking, withering, and softening of the melons, which were caused by each

of several chemicals. Hydrated lime, air-slaked lime, and unburned ground limestone did not cause appreciable injury. The most pronounced injury in the shipping tests is said to have resulted when moist, scant bedding was used in the cars.

From the results obtained, it is considered evident that thorough cleaning of the cars before loading, combined with the use of paper side wall protection and ample dry bedding, about 225 lbs. of straw to the car, will almost entirely prevent chemical injury to watermelons in transit.

[Cranberry disease investigations], C. S. BECKWITH and B. R. FUDGE (*New Jersey Stas. Rpt. 1928, pp. 167–169*).—Frost injury is said to have interfered seriously with experiments for the control of cranberry rot by spraying and dusting. The sprayed plats had very little rot, but the yield was small, due to frost. The unsprayed plats were severely attacked. Dusting did not give as good protection as spraying. As a result of their experiments, the authors recommend that the first spraying be made before the plants bloom, followed by a second immediately after blooming is over, and a third about two weeks later. The prebloom application is considered to be very important.

Injury through spraying with Bordeaux mixture on sanded bogs in Massachusetts has been reported by Franklin (E. S. R., 33, p. 350), but similar injury is said to have not been observed in New Jersey on unsanded bogs. A series of experiments was conducted, in which one plat had an inch layer of peat overlying the soil, and another was covered with sand. Bordeaux mixture was applied in a quantity equal to that represented by two years' spraying. After a heavy rain soil samples were analyzed, and it was found that the peat had taken up nearly all the copper, while in the sanded plat it was washed down where it would doubtless come in contact with the cranberry roots, causing their injury.

The authors believe that large applications of Bordeaux mixture to sanded bogs should be discouraged.

A study of decay in citrus fruits produced by inoculations with known mixtures of fungi at different constant temperatures, G. SAVASTANO and H. S. FAWCETT (*Jour. Agr. Research [U. S.], 39 (1929), No. 3, pp. 163–198, figs. 10*).—Experiments are reported in which citrus fruits were inoculated with cultures of a number of fungi and the rate of decay, as influenced by the species of organisms and temperature of fruit after inoculation, was determined.

"When inocula containing certain mixtures of spores were used the rate of decay greatly increased; when inocula containing certain other mixtures were used the rate was lower than when any one of the components of the mixture was used alone; and when inocula containing still other mixtures were used the rate approximated that of the most rapid component acting alone. With most mixtures temperature had an important influence on decrease or increase in rate.

"A mixed inoculum containing spores of *Penicillium italicum* and *P. digitatum* gave increased rates of decay on lemons at the higher and lower ends of the temperature range. The mixture also produced a reddish discoloration of the decayed tissue.

"A mixed inoculum containing *Aspergillus niger*, *P. italicum*, and *P. digitatum* produced at the lower temperatures higher rates of decay than the highest rate of any one of the fungi alone.

"*Oospora citri-aurantii* in mixtures with *P. italicum* and *P. digitatum* caused greatly accelerated rates of decay, especially on lemons, where at low and intermediate temperatures the rate was more than the sum of the rates produced by the fungi alone.

"*Botrytis cinerea* in mixtures with *P. italicum* and *P. digitatum* appeared to have a depressing effect on the rate of decay.

"In other mixtures *B. cinerea* appeared as a rule to have a depressing effect at low and intermediate temperatures, *A. niger* to have an accelerating effect at intermediate and high temperatures, and *O. citri-aurantii* to have an accelerating effect at nearly all temperatures."

The Rhizoctonia damping-off of conifers, and its control by chemical treatment of the soil, J. S. Wiant (*New York Cornell Sta. Mem. 124 (1929), pp. 64, pls. 6, figs. 6*).—The results are given of three years' investigations on damping-off of conifers conducted at Ithaca, N. Y., and at Keene, N. H. Isolations from diseased seedlings at Ithaca indicated that Rhizoctonia and Pythium were the pathogenes causing the disease. At Keene, Rhizoctonia was practically the only organism involved. In greenhouse inoculation experiments Rhizoctonia and Pythium were found to be highly virulent, while Fusarium and Alternaria gave negative results. Cross-inoculation experiments with 13 strains of Rhizoctonia on vegetables and conifers indicated considerable differences in virulence between the strains.

Cultural characters of 23 strains of Rhizoctonia are described. No correlation was found between the results of cross-inoculation studies and those of the cultural studies. With possibly one exception, the strains used were considered to fall within the limits of *R. solani*.

In experiments for the control of damping-off, the application of chemicals after emergence of the seedlings was not found to be practicable. Single applications of chemicals at the time of seeding, with any one of a number of different materials, were found to give excellent control under conditions where extremely high losses occurred in the untreated plats. Applications of dry chemicals at the time of preparing the seed beds were found to be as effective as liquid treatments. Aluminum sulfate, corrosive sublimate, and several organic mercury compounds were used in liquid and dry forms, and single treatments at the time of seeding were found effective in controlling damping-off of Norway spruce, red pine, and white pine. The author states that aluminum sulfate was less expensive than any of the other materials, and that the organic mercury preparations, particularly dusts, were the most expensive.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Directory of field activities of the Bureau of Biological Survey (*U. S. Dept. Agr., Misc. Pub. 49 (1929), pp. II+38, fig. 1*).—This is a directory of the field activities of this bureau in vest pocket form.

Report of the department of biology, T. C. Nelson (*New Jersey Stas. Rpt. 1928, pp. 105–112, pl. 1, fig. 1*).—This reports upon the work conducted with the oyster under the headings of floating problems; experimental feeding, including a Note on the Density of Algal Spores in Water by G. W. Martin; spawning and setting; and seed production in Delaware Bay.

Lives of game animals, I–IV, E. T. Seton (*Garden City, N. Y.: Doubleday, Doran & Co., vols. 1 (1925), pp. XXXIX+640, illus. 152; 2 (1926), pp. XVII+746, illus. 142; 3 (1927), pp. XIX+780, illus. 144; 4 (1928), pp. XXII+949, illus. 197*).—This is an account of the life history and habits of those land animals in America north of the Mexican border considered "game," either because they hold the attention of sportsmen or receive the protection of law. Volume 1 deals with cats, wolves, and foxes; volume 2 with bears, raccoons, badgers, skunks, and weasels; volume 3 with deer, antelope, buffalo, sheep, and peccary; and volume 4 with squirrels, rabbits, armadillo, and opossum.

The problems of applied entomology, R. A. WARDLE (*New York: McGraw-Hill Book Co., 1929, pp. XII+587, pls. 4, figs. 27*).—The first part of this work, which is supplementary to that by the author and Buckle previously noted (E. S. R., 50, p. 253), deals with the general problems (pp. 1–247) and part 2 with area problems (pp. 248–519). Part 3 consists of a bibliography (pp. 520–561) and subject and author indexes (pp. 563–587).

[Work in entomology at the Michigan Station] (*Michigan Sta. [Bien.] Rpt. 1927–28, p. 15*).—In joint investigations conducted by the entomological and horticultural sections during the two-year period under report it was found that a late dormant season application of one of the oil emulsions or miscible oils will result in a comparative freedom from the pear psylla during the first half or two-thirds of the growing season and sometimes for the entire season. When necessary the oil treatment should be supplemented by one or two applications of a nicotine spray or dust, or better still by a single application of one of the summer oils. Carefully conducted experiments showed conclusively that the oil sprays are not to be relied upon for combating aphids attacking the tree fruits, but that nicotine sulfate should be applied in the late dormant or prepink stage.

It was found that finely powdered Paris green mixed with talc or a cheap grade of flour at the rate of 1 part of the poison to 20 of the diluting material and applied as a dust is more effective in controlling the mint flea beetle than other insecticides employed.

Report of the department of entomology, T. J. HEADLEE ET AL. (*New Jersey Stas. Rpt. 1928, pp. 125–164, 169, 170, 172–189, pl. 1, figs. 4*).—A tabulated systematically arranged list of insects dealt with in correspondence during the year, with date and locality of occurrence, is followed by a discussion of climate and insect investigations in which reference is made to a study of the thermal constant for codling moth emergence, an account of which has been noted (E. S. R., 60, p. 848). In the application of this information for the practical timing of codling moth sprays, 39 temperature stations were established in different parts of the State. The reports of each week's thermometer readings and adult codling moth catches in bait pans were forwarded to the central office where the accumulated temperatures were calculated and the bait pan catches recorded. It was found from a study of the data that with a few exceptions these stations may be separated into five groups. By grouping the stations effective day degrees of temperature were charted and applied to the thermal constants as a means of determining when spray applications should be made. Information based upon these studies as to the time when a cover spray should be applied and maintained was distributed through the extension specialist in fruit growing and through the county agents. Data on the relation of the overwintered generation to thermal constants at Glassboro and on the effect of diurnally varying temperature in comparison with a constant temperature, which represents the mean temperature of the diurnal variable, are reported upon in detail in tabular form. A chart is given which shows the emergence of the overwintered generation of codling moth under outdoor diurnal temperature, under controlled diurnal temperature, and under a constant temperature run at the average of the controlled diurnal. In reporting upon the work with the codling moth, reference is made to the results of work conducted at Glassboro in 1927, as previously noted (E. S. R., 60, p. 456).

In an attempt to determine where the large number of codling moth larvae succeed in passing the winter, two large cages, each completely covering a good sized bearing apple tree in a cultivated orchard, were erected, and each of the cages was divided into three chambers. The upper chamber included all of

the top of the tree, beginning on the large branches a few inches above the main crotch, the second chamber included the trunk of the tree from the surface of the ground at the base of the trunk to the floor of the upper or first chamber, and the third chamber included all of the soil within the range of the cage. The data obtained, presented in tabular form, show that of a total of 77 emerging codling moths, 9 per cent came from the top, 91 per cent from the trunk in the rough barked region, and none from the ground. A trunk treatment with pineole soluble, both alone and impregnated, the details of which are presented in tabular form, led to the conclusion that it is as efficient alone as when used with the addition of certain chemicals. Used on trees with a diameter of 10 in. at the base, 1 qt. of pineole soluble was found to be sufficient to produce 100 per cent kill of the overwintering larvae without injury to the trees. In testing white oil impregnated with a pyrethrum extract as a nonarsenical spray for the control of the codling moth, on a block of four varieties, a control of first brood codling moth was obtained which was fully equal to or possibly a little better than that obtained with the standard sprays. The drop of set fruit in late June and early July, however, was much more severe. Furthermore, there appeared, particularly in the Stayman Winesap variety, a decided case of chlorosis.

The use of the pyrethrum sodium oleate mixture as recommended and used for Japanese beetle contact spray proved lethal to the common rose bug.

In work with the oriental peach moth B. F. Driggers reports upon insecticidal studies. In laboratory work with liquid sprays reported on in tabular form eight different combinations were tested, of which Volck oil at 1 and 1.5 per cent actual oil, nicotine sulfate, and a white oil extract of pyrethrum proved the most effective in killing the eggs and young larvae after they emerged from the eggs. Nicotine sulfate alone was much more effective in killing eggs in the black spot stage and just emerged larvae than was nicotine sulfate with resin fish oil soap added. The results obtained in late summer with white oil extract of pyrethrum were so promising as to warrant a more thorough investigation of oil extracts of pyrethrum. In laboratory tests with several nicotine dusts, conducted in an effort to kill the eggs and young larvae and reported on in tabular form, a much greater kill was obtained when the twigs were dusted while wet. This is thought to have been due to the adherence of more dust to the wet than to the dry foliage. Field tests were made with (1) Volck oil emulsion 1.5 per cent and (2) nicotine sulfate 1:800, which were applied five times to destroy the first brood eggs and larvae, commencing on May 4 and ending about June 16. In injured twig counts made on June 1 and again on June 20, it was found that the number of injured twigs per tree increased in proportion to the proximity of the mixed apple and peach orchard. The conclusion that enough had escaped to build up to a normal infestation by the time the third brood larvae were ready to enter the fruit was supported by the fact that of 1,177 fuits from five Elberta trees cut and examined 21 per cent were found infested. It is pointed out that the larvae of the first and second broods confine their activities to the succulent twigs for the most part and as a result the fruit usually escapes serious damage from the larvae of the first two broods. From the latter part of July on, however, the twigs of the peach tree are usually hard and the newly hatched larvae start entering the fruit in increasing numbers.

Since satisfactory control had not been obtained by spraying operations directed against the first brood eggs and larvae, several insecticides were tested in an effort to control the third brood eggs and larvae. The application of Volck oil, ground tobacco dust, and nicotine sulfate gave percentage reduc-

tions of 2.8, 6.1, and 6.2, respectively, none giving sufficient control of the third brood eggs and larvae to warrant a further test. A test made of the effect of white oil emulsion applied early and late in the season is reported upon in tabular form. In tests of dormant season sprays for the pest, paranitrochlorobenzene dissolved in pineole soluble at the rate of 1 lb. to 1 qt. of oil and diluted with water was ineffective. It was, however, the most effective of the three materials tested, with an emergence of 12.5 per cent. Records of emergence of spring brood adults in cages inclosing nine 6-year-old Elberta seedlings show that a considerable number of the overwintering larvae hibernate on some portion of the tree above ground.

Studies of arsenical injury, correctives, and adhesion of spray mixtures to foliage by J. M. Ginsburg have been noted from Bulletin 468 (E. S. R., 61, p. 451), as has also a comparison made of complete and incomplete digestion of sprayed apple foliage in determining arsenic by the Gutzeit method (E. S. R., 60, p. 113). An apparatus for collecting measured areas of sprayed foliage for chemical analyses is described and illustrated by Ginsburg.

In order to find a more stable emulsifier, tests were made by Ginsburg of 20 gums with four different oils varying in viscosities from 20 to 200 Saybolt 100. Only four of these gums proved efficient, namely, arabic, kino, gamboge, and Indian gum, but Indian gum was superior to the others, only 0.5 per cent being sufficient to produce a solid emulsion which remains stable for several weeks without the addition of a preservative. Studies by Ginsburg of the effect of different oils on foliage were continued. The fact previously reported that Nujol, a high viscosity white oil, is not injurious to peach or apple foliage was substantiated. Of the vegetable oils tested, peanut and corn oil were the least injurious, and mustard and linseed oils the most injurious.

Brief reference is made to investigations of the adhesion of lead arsenate and its accumulation on apple foliage.

In insecticidal investigations conducted during the year by Ginsburg with several groups of chemicals, the honeybee was selected as an indicator of toxicity, the details being presented in tabular form. It was found in a comparison of the data that pyrethrum in the form of an alcoholic extract from *Pyrethrum cinerifolium* ranks very high as a stomach poison to honeybees. Of all the chemicals tested in this investigation, pyrethrum and 3, 5–dinitrocresol came nearest in toxicity to As_2O_3. It is pointed out that the high toxicity of 3, 5–dinitrocresol to *Aphis rumicis* has also been observed by Tattersfield and Gimingham (E. S. R., 55, p. 852). Dinitrocresol, however, is very toxic to foliage and also to mammals, as tests carried out on peach trees and on white rats, respectively, have shown.

A brief reference is also made to vegetable insect investigations conducted during the year, in the course of which it was found that pyrethrum extract and sodium oleate soap in the proportions recommended and used by Headlee for the contact spray against the Japanese beetle (E. S. R., 59, p. 854) would destroy striped cucumber beetle and squash bugs. It was also found that the same spray could be used to destroy asparagus beetles attacking the early cutting asparagus. The pyrethrum mixtures distinctly show not only an optimum concentration for toxicity, but that when the dosage is increased beyond this optimum strength the percentage of kill actually decreases materially.

A report on cranberry and blueberry investigations includes a brief reference by S. B. Hutton (pp. 169, 170) to cranberry insects observed. The three most important of these in the number of individuals were the blunt-nosed leafhopper (*Euscelis striatulus* Fall.), the sharp-nosed leafhopper (*Platymetopius frontalis* Van D.), and the yellow leafhopper (*Thamnotettix smithi* Van D.).

It was found that ordinary spraying with nicotine solution, 1:500, under fair conditions killed 50 per cent of these insects. From 85 to 90 per cent of the hoppers were killed when a more thorough spraying was made, and 95 per cent when sprayed from two directions. Reference is also made to the cumulative effect of acid lead arsenate sprayed on cranberry vines.

In work with wireworms at Richfield, it was found that in combating them on a broad field basis a dosage of 0.1 oz. of granular calcium cyanide per square foot, when applied late in May or early in June, is necessary.

A report upon bee investigations by R. Hutson deals with the moving of overwintered bees for orchard use; shipping of package bees; breeding of bees, including a disease-resistant yard and the production yard; and the reappearance in New Jersey of the disappearing disease.

In reporting upon mosquito control, biological studies, mosquito traps, and mosquito fighting machinery are briefly referred to, followed by a report of studies of mosquito oils by Ginsburg, and State inspection, county mosquito accomplishments, New Jersey Mosquito Extermination Association, and mosquitoes of the year, all by F. W. Miller.

The study conducted in search of a dependable mosquito oil led to the following conclusions: (1) The most efficient mosquito oil was undoubtedly a light crude oil having a specific gravity of 33° B. All the crude oils tested encountered, however, objections of fire hazard and irritation to human skin. (2) The oil which ranked next to the crude in efficiency consisted of a mixture of tar oil with either a light crude or a light distillate. The following objections were raised against the tar oil: (*a*) Discolors treated area, (*b*) stains clothing and containers, and (*c*) attacks rubber hose and boots of operator more rapidly than the distillate fuel oils. (3) Two light distillate oils produced comparatively efficient larval control and no objection to their use was encountered. One of these oils is at present being used in Union and Morris Counties with good results, both as far as killing and duration of the film are concerned. (4) The spreading quality of the heavier oils was greatly improved by the addition of small quantities of coal tar acids and unsaturated hydrocarbons. It is concluded from the results thus far experimentally obtained that an efficient mosquito oil should possess the following specifications: Boiling range 330 to 720° F., sp. gr. 32 to 35° B., flash point 130 to 150° F., cold test 0°, viscosity 50 Saybolt 100, and color straw to yellow.

Research in zoology and entomology, Z. P. METCALF ET AL. (*North Carolina Sta. Rpt. 1928, pp. 88–90*).—In work with the pecan spittle insect, which caused serious injury to pecans near Wilmington, nicotine sulfate, 1 part to 400, and calcium cyanide "A" dust both gave effective control. The fact that eggs from the overwintering corn root worm adults are laid in the spring is thought to indicate that winter plowing and fallow cultivation will give satisfactory control.

Under conditions of high evaporation a 2 per cent soap spray is found to be less effective against the harlequin bug than a 0.5 per cent spray in a saturated atmosphere. Spraying in the field on bright, dry days gave poor results, but during humid weather the effectiveness was limited only by the cover protection afforded by the plants.

Progress and results of investigations in the department of entomology, W. J. SCHOENE (*Virginia Sta. Rpt. 1920–1927, pp. 46–51*).—This is a brief summary of work conducted from July, 1919, to July, 1927, the results of which have been reported upon. The insects dealt with include woolly apple aphid, red-banded leaf roller (*Argyrotaenia* (*Eulia*) *velutinana*), southern corn stalk borer, catalpa mealybug (*Pseudococcus comstocki*), squash beetle, codling

moth, pale-striped and banded flea beetles, leafhoppers, and oriental peach moth (*Laspeyresia molesta*). Mention is also made of breeding resistant spinach, spreader tests on apples and peaches, and dusting and spraying work on truck crops.

[Contributions on economic insects] (*Ztschr. Angew. Ent., 14 (1928), No. 1, pp. 1–224, pl. 1, figs. 99*).—The contributions here presented (E. S. R., 60, p. 844) are as follows: A Contribution to the Biology of the Red Forest Ant (*Formica rufa* L.), with Particular Consideration of Climatic and Forest Conditions, by G. Wellenstein (pp. 1–68), which includes a list of 43 references to the literature; The Influence of Hunger in the Larval Stage on the Number and Size of the Ovarian Tubes of Some Diptera, with Some Observations on the Chaetotaxy of Starved Larvae and the Action of Different Physical and Chemical Influences on the Development of *Calliphora erythrocephala*, *Stegomyia fasciata*, and *Anopheles maculipennis*, by K. Weidling (pp. 69–85); On Tea Pests in the Dutch East Indies and Their Control.—IV, Further Knowledge of *Euphorus helopeltidis* Ferrière, Braconid Parasite of the Tea Capsid [*Helopeltis theivora*] [E. S. R., 58, p. 158], by R. Menzel (pp. 86–90); Experiments on the Flight Stimulus and the Periodic Occurrence of Different Forms of Activity in the Cockchafer (*Melolontha melolontha* L.), by K. Meunier (pp. 91–139); Experimental Investigations of the Biology of *Dermestes lardarius* L. and *Dermestes vulpinus* F.: A Contribution to the Question of Inconstancy in the Number of Molts of Coleoptera, by J. Kreyenberg (pp. 140–188), which includes a list of 83 references to the literatnre; and *Cartodere filiformis* Gyll. and *C. filum* Aubé (Ord. Coleoptera Fam. Lathridiidae) as Pests in Preparations of Yeasts, by M. Dingler (pp. 189–224).

[Contributions on economic entomology] (In *Proceedings of 3. Pan-Pacific Science Congress, Tokyo, 1926. [Tokyo: Natl. Research Council of Japan], 1928, vols. 1, pp. 1211–1220; 2, pp. 2029–2067, 2069–2090*).—The contributions on economic entomology presented at the Third Pan-Pacific Science Congress, held at Tokyo, October 30 to November 11, 1926, include the following: Biological Studies of the Granary Weevil, *Calandra granaria* L., by S. Nakayama (pp. 1211–1220); A Stink-bug [*Rhynchocoris humeralis*] Injurious to Citrus in South China, by W. E. Hoffmann (pp. 2030–2038); Termites, or White Ants, in Hawaii, by D. T. Fullaway (pp. 2039–2050); On the Distribution in Japan of Insects Injurious to the Rice Plant with Reference to Their Presence in Adjacent Parts of the Orient, by G. Okajima (pp. 2050–2067), which includes a list of 32 references to the literature; Insects in Relation to the Introduced Cultivated Element of the Philippine Flora, by L. B. Uichanco (pp. 2069–2076); Insects on Coconuts in Malaya, by G. H. Corbett (pp. 2077–2081); The Malaysian Coconut Zygaenid (*Artona catoxantha* Hamps.) and Its Relation to *Levuana iridescens* B. Baker in Fiji, by B. A. R. Gater (pp. 2082–2085); and *Adoretus sinicus* and Its Natural Enemies in the Orient, by D. T. Fullaway (pp. 2086–2090).

In the account of the rice insects in Japan, Okajima gives a tabulated list of 157 which cause injury to the rice plant, 40 of which are indigenous to Japan proper. The zonal distribution of the 157 forms is indicated in the tabulation.

Spray calendar: How to recognize and fight the insect pests attacking canners' crops, J. J. Davis (*Canning Trade, 51 (1929), No. 36, pp. 24–28*).—This is a spray calendar prepared by the Indiana Experiment Station relating to bean, cabbage, pea, spinach, tomato, corn, cucumber and melon, and sweetpotato insects.

Some common sucking insect pests of evergreens, E. I. McDaniel (*Mich. Agr. Col. Ext. Bul. 76 (1929), pp. 14, figs. 8*).—A brief popular account is given of several of the more important insect and mite enemies of evergreens in Michigan.

The true cricket—a serious cotton pest in California, E. A. McGregor (*U. S. Dept. Agr. Circ. 75 (1929), pp. 8*).—This is a report of observations of the life history and habits of the field cricket in the Imperial Valley, including notes on its natural enemies and a brief discussion of control measures.

This cricket is a source of serious injury in the Imperial Valley, where large fields of seedling cotton have been completely devastated or at best only a 10 per cent stand left. Replanting is said to be necessary quite frequently, and it is not unusual for planters to replant twice, and even then a good stand is not always obtained. Crickets are everywhere present from about April 1 until the occurrence of frosts, appearing in greatest abundance during July, August, and September. The injury to cotton is produced by feeding activities upon the stem and foliage. If the plant is very young, the stem is usually severed a short distance above the ground. When the plant is from 3 to 8 in. high, the injury consists of gnawing and rasping the stem at some distance above the soil. When the plant is from 8 to 12 in. high, it usually suffers only in the region of the apical bud from the gnawing or complete severance of the stem at this point.

While there is no distinct demarcation between broods, there appear to be three fairly well-defined hatchings. The overwintering eggs give rise to the spring generation usually about May 1. Whether hibernation in a strict sense occurs in the region under observation is considered doubtful, the overwintering individuals assuming merely a partially quiescent condition.

A large red mite of the genus Euthrombidium is said to be the only important parasite with which the cricket has to contend. Many crickets were seen in the field so weakened by this mite that they were barely able to move about. Reference is made to a number of birds which have been reported to feed upon the pest. Control measures mentioned include certain cultural practices, placing of attracting lights around cotton fields, and the use of poison bait.

Notes on a squash-bug of economic importance, W. E. Hoffmann (*Lingnan Sci. Jour., 5 (1927), No. 3, pp. 281–292, figs. 13*).—This is a report of studies of the life history and habits of *Acanthocoris scabrator* (F.), which is a serious pest of Cape-gooseberry in the vicinity of Canton, China, and of two varieties of pepper, eggplant, and squash. It is said to be held in check by a small hymenopterous parasite, which at times results in almost 100 per cent parasitism.

Strawberry root louse, J. H. Clark (*New Jersey Stas. Rpt. 1928, pp. 221–223*).—In control work conducted with *Aphis forbesi*, dusts containing nicotine, Cyanogas, and a combination of the two were applied. No definite conclusions could be deduced. Experiments conducted indicated that tobacco dust is ineffective as a means of control.

A contribution to the biology and control of the green citrus aphid, Aphis spiraecola Patch, R. L. Miller (*Florida Sta. Bul. 203 (1929), pp. 429–476, figs. 18*).—A report of studies of the life history and habits of the green citrus aphid and the control effected by predators, parasites, and fungus diseases.

This aphid while known to attack spirea in the northern United States was first found in Florida in 1923, where it can live upon a great number of host plants but thrives only on tender growth on citrus, spirea, and apple. Other plants, however, serve as "overflow" hosts and aid in carrying the aphid over between flushes of tender growth on citrus. While all varieties of citrus are attacked, those that grow most slowly and continuously are most severely damaged. Attacked trees become dwarfed, the leaves are curled, the amount of fruit set is small, and in general the tree is in a poor state of growth.

"The green citrus reproduces asexually during the entire year at Lake Alfred, while eggs are deposited in the northern part of the State. The average length of life for the year August, 1926, to August, 1927, was 16.7 days for 198 females. The longest life recorded was 49 days during December and

January. The nymphal period ranged from 4 to 16 days, being longest during the winter and shortest in September. The average nymphal period was 6.93 days for 198 females. The rate of reproduction was greatest at a temperature of 75 to 80° and averaged 29.11 for 198 females. The maximum number produced per day by one female was 16.

"Aphids fed in crowded conditions or on hardening foliage produce many winged forms, while if fed on tender growth separately no winged forms appear. The citrus aphid reacted very little to gravity, concentrated under the shade produced by cheesecloth, concentrated at the temperature 72 to 93° F., and in captivity were slightly attracted to their preferred host plants. Aphids lived twice as long when subjected to 100 per cent humidity as when humidity was low. A large number of insects were found feeding on the honeydew secreted by the citrus aphid.

"A great number of natural agencies tend to control the citrus aphid, but none of these are efficient enough to make artificial control unnecessary. Rain, wind, and changes of temperature are all destructive under some conditions. Many species of lady beetles and syrphus fly predators as well as lacewing flies and others were observed, but none of these were able to do more than partially check the aphid increase. One hymenopterous parasite attacks the citrus aphid, but is not generally able to emerge successfully from the aphid's body. A fungus disease is ever present but during 1926–27 was of little value as a control. This pest can be successfully controlled by either spraying or dusting if done thoroughly and in good time. In general, oils were not satisfactory aphicides but some seem quite promising. Extracts of Derris and nicotine sulfate were most successful and gave the most consistent control."

A list is given of 33 references to the literature.

Aleyrodidae of Brazil, II [trans. title], G. Bondar (*Bol. Lab. Path. Veg. [Bahia], No. 5 (1928), pp. [3]+37, figs. 19*).—This continuation of the account previously noted (E. S. R., 50, p. 556) presents descriptions of 19 species, of which 17 are described as new.

Experiments with oil sprays in controlling the red scale, R. H. Smith (*Citrus Leaves, 9 (1929), No. 3, pp. 4, 5*).—This is a report of work at the California Citrus Experiment Station on red scale, the most difficult to control of the scale insects attacking citrus trees. It is pointed out that oils ranging from 90 to 110 seconds in viscosity, or heavy oils, are not suitable for applying to orange trees. At the present time nothing has been found that approaches the petroleum oils in effectiveness against the red scale.

The butterflies and moths of New Zealand, G. V. Hudson (*Wellington: Ferguson & Osborn, 1928, 2. ed., rev. and enl., pp. XI+386, pls. 62; rev. in Ent. Mo. Mag., 3. ser., 15 (1929), No. 170, pp. 43–45*).—The present work, which succeeds that published in 1898 by the author,[1] deals with and illustrates no fewer than 1,271 species. Of these all but 93 are peculiar to New Zealand, and of the latter 29 have been introduced by human agency and 8 are cosmopolitan species.

Following a brief historical sketch, chapter 1 considers various modes of collecting and observing butterflies and moths in New Zealand (pp. 1–7); chapter 2 the general characters and structure of the Lepidoptera (pp. 8–11); chapter 3 the habits and geographical distribution of New Zealand Lepidoptera (pp. 12–17); chapter 4 certain phenomena exhibited by the Lepidoptera (pp. 18–22); and chapter 5 classification, nomenclature, and general remarks (pp. 23–25.) The fourteen chapters which follow present descriptions and notes on the butterflies and 13 families of moths. The systematic portions of the work

---

[1] New Zealand Moths and Butterflies (Macro-lepidoptera), G. V. Hudson. London: West, Newman & Co., 1898, pp. XIX+144, pls. 13.

have been almost entirely founded on the descriptions of genera and species of the New Zealand Lepidoptera by E. Myrick, which have appeared, chiefly in the Transactions of the New Zealand Institute, from 1883 onward. A tabulated census of species follows (p. 372), and an appendix is devoted to a brief descriptive list of the plants mentioned in the work (pp. 373–377), by S. Hudson. In the first 9 plates are presented structural and neurational details of many generic types, and of the 52 plates in color 4 are devoted to the earlier stages and the remainder to the perfect insects. All but a very few of the species are represented by colored drawings by the author, in the majority of cases both sexes being shown. These, together with others illustrating more striking variations, extend the number of specimens represented to approximately 2,000. The review is by J. J. Walker.

The bollworm or corn ear worm as a cotton pest, F. C. Bishopp (*U. S. Dept. Agr., Farmers' Bul. 1595 (1929), pp. II+14, figs. 12*).—This is a revision of and supersedes in part Farmers' Bulletin 872 (E. S. R., 38, p. 261).

Morphological studies of the head and mouthparts of the mature codling-moth larva, Carpocapsa pomonella (Linn.), A. W. Lopez (*Calif. Univ. Pubs. Ent., 5 (1929), No. 3, pp. 19–36, figs. 16*).—An anatomical contribution presented in connection with a list of 11 references to the literature.

Host selection by the spruce budworm, S. A. Graham (*Mich. Acad. Sci., Arts, and Letters, Papers, 9 (1928), pp. 517–523*).—The author concludes that in the forms of the spruce bud worm there are two species in the making, at present taxonomically the same but ecologically different. It is pointed out that from an economic standpoint this host selection of the spruce bud worm is of special importance, since its control depends primarily upon methods of forest management that will reduce the proportion of favorite hosts in a forest.

Control of the codling moth, A. J. Ackerman (*Tenn. State Hort. Soc. [etc.] Proc., 22 (1927), pp. 39–44*).—A brief discussion of the control of the codling moth, particularly as related to Arkansas conditions, where investigations of the pest have been conducted by the author.

Investigations in codling control and removal of spray residue from pears, F. W. Pettey, A. Skibbe, and F. de Villiers (*Union So. Africa Dept. Agr., Sci. Bul. 64 (1928), pp. 36, figs. 2*).—A brief introductory account in which it is pointed out that heavy spraying results in much spray residue and that the skin of sprayed pears contains most of the arsenic is followed by a report of codling moth control and reduction of arsenic in pears in 1927 (pp. 5–20). This includes a report of tests with substitutes for lead arsenate sprays in codling moth control.

Recent experiments in removal of spray residue from apples and pears by treatment with hydrochloric acid, 1927–28, are reported upon in an addendum (pp. 21–23). The details are presented in tabular form under the headings of analyses of pears sprayed with lead arsenate, 1926; records of infestations as a result of spray programs, Elsenburg, 1926–27; records of effect of spray programs on amount of residue in pears and the efficiency of various methods of spray residue, Elsenburg, 1926–27 (a sample consisted of 20 to 30 pears); records of effect of spray programs on amount of residue on pears and the efficiency of various methods of removal of spray residue, Elsenburg, 1926–27 (a sample consisted of 20 pears); records of fermenting bait traps—codling control, 1926–27; places of codling infestation in orchard-sprayed pears; records of codling infestation and number of adult codling moths caught in bait trap trees, Elsenburg, 1926-27; and record of pears treated with sweetened lead arsenate as for fruit fly control v. pears sprayed with lead arsenate, Elsenburg, 1926–27.

Laboratory studies in the control of codling moth larvae on pears, F. W. PETTEY ([*Union So. Africa Dept. Agr.*], *Sci. Bul. 65* [*1928*], *pp. 13, figs. 5*).—This is a report of work in which unsprayed pears free from codling moth infestation and stings were given various spray treatments. Newly hatched larvae were then placed thereon and kept under observation. The methods were those employed by Smith (E. S. R., 55, p. 355) in California and by Newcomer (E. S. R., 55, p. 761) in Washington.

In the laboratory the addition of treacle to the lead arsenate sprays apparently decreased somewhat the efficiency of the lead arsenate, and in the orchard it failed to produce better results and caused rusty spots to form on the surface of the fruits. It was found that lead chromate will not effectively control the codling moth, and that neutral lead arsenate is less effective than acid lead arsenate. About two-thirds of the larvae that escaped the standard lead arsenate spray containing no spreader on single full-grown Kieffer pears entered between the spray blotches, and the great majority of the remainder entered at the margin of the blotches. Larvae eating through the dried spray blotches entered, generally, in the upper half of the blotch, which formed a thinner film than the lower half of a spray spot. Margins of the spray spots furnished a raised surface or ridge which led the larvae to bite into the skin at those points.

These results indicate that lead arsenate is far from a perfect measure of control of codling moth when the fruit is large and when the majority of the larvae attempt to enter the sides.

Cattle grubs or heel flies with suggestions for their control, F. C. BISHOPP, E. W. LAAKE, and R. W. WELLS (*U. S. Dept. Agr., Farmers' Bul. 1596* (*1929*), *pp. II+22, figs. 19*).—This is a practical summary of information on the ox warbles, including the common cattle grub (*Hypoderma lineatum* De Villers), found throughout the entire United States, and the northern cattle grub (*H. bovis* DeG.), which occurs in the Northern States. The account includes a general discussion of the two species and their habits, seasonal history, losses, distribution and method of spread, hosts, factors of natural control, methods of combating, and possibilities of eradication.

A case of dermal myiasis caused by Phormia regina Meig., M. A. STEWART (*Jour. Amer. Med. Assoc., 92* (*1929*), *No. 10, pp. 798, 799, figs. 3*).—An account of parasitism in a human adult by the queen or black blowfly (*P. regina*).

On the determination of plague-infected fleas by the method of preparation and seeding of the isolated alimentary canal [trans. title], V. A. BYCHKOV (BICHKOV) and A. K. BORZENKOV (*Vest. Mikrobiol., Epidemiol. i Parazitol.* (*Rev. Microbiol., Épidémiol. et Parasitol.*), *8* (*1929*), *No. 1, pp. 20–32, figs. 14; Eng. abs., pp. 112 113*).—The method here described makes it possible to investigate hundreds of fleas daily.

The Mexican bean beetle in eastern Virginia (preliminary report), P. J. CHAPMAN and G. E. GOULD (*Virginia Truck Sta. Bul. 65* (*1928*), *pp. 675–697, figs. 6*).—This is an account of studies of the life history and habits of and control measures for the Mexican bean beetle, which became generally established in Tidewater Virginia during the season of 1928.

Epidemic attacks by the sal heartwood borer (Hoplocerambyx spinicornis Newm., fam. Cerambycidae) in the forests of South Mandla Division, Northern Circle, Central Provinces, with special reference to the period 1924–25 to 1926–27, W. A. MUIR (*Indian Forest Rec., 13* (*1929*), *No. 5, pp. II+69, pls. 13, fig. 1*).—An extended report of studies of an important pest in the Central Provinces, India, made during a severe outbreak.

The southern pine beetle: A serious enemy of pines in the South, R. A. ST. GEORGE and J. A. BEAL (*U. S. Dept. Agr., Farmers' Bul. 1586* (*1929*), *pp.*

II+18, figs. 17).—This is a revision of and supersedes Farmers' Bulletin 1188, by Hopkins, previously noted (E. S. R., 44, p. 855).

Combating infectious diseases of bees in Switzerland and Germany [trans. title], TOUMANOFF (*Rec. Méd. Vét., 105 (1929), No. 3, pp. 146–152*).—This is a summary of the work under way in these countries, including legislative measures, indemnities, etc.

The raspberry crown borer, J. H. CLARK (*New Jersey Stas. Rpt. 1928, pp. 214–220*).—This is a report of studies made of the raspberry crown borer, *Bembecia marginata*, which constitutes one of the most important problems of the berry-growing industry in New Jersey and with which borer almost every red raspberry plant in the principal raspberry section of the State is infested. It deals with the seasonal development in 1927, effects of mounding as a means of inducing the larvae to form their cells above the usual soil level, removal of eggs by pruning, use of stomach poisons and of ovicides, and spray injury. Much of the data is presented in tabular form. The results secured thus far are considered insufficient to warrant the recommending of an ovicide for the control of the borer, although they do indicate that the eggs can be killed, and point toward the possibility of a solution for the problem.

Three new species of the hymenopterous family Encyrtidae from New South Wales, P. H. TIMBERLAKE (*Calif. Univ. Pubs. Ent., 5 (1929), No. 2, pp. 5–18, figs. 5*).—Three species collected by H. Compere at Sydney, N. S. Wales, while searching for parasites of the citrophilus mealybug (*Pseudococcus gahani* Green) are here described. They are *Tetracnemus pretiosus* n. sp. and *Anusoidea comperei* n. sp., reared from this mealybug, the former of which is being reared and colonized in large numbers in California, and *Anarhopus sydneyensis*, representing a new genus and species, which oviposited freely in *P. longispinus* (Targ.) as well as in *P. gahani*. The genus Anarhopus is erected.

A revision of the North American Ichneumon-flies of the genus Mesostenus and related genera, R. A. CUSHMAN (*U. S. Natl. Mus. Proc., 74 (1929), Art. 16, pp. 58, figs. 8*).—A revision of an important group of parasites. The genera Agonocryptus, Messatoporus, and Acerastes are erected and 13 species described as new.

ANIMAL PRODUCTION

Commercial feeding stuffs, L. S. WALKER and E. F. BOYCE (*Vermont Sta. Bul. 293 (1929), pp. 32*).—This is the usual report (E. S. R., 61, p. 59) of the analyses for protein, fat, and fiber of 1,220 samples of feeding stuffs collected for official inspection during December, 1928. The brands fulfilling their guaranties and the found analyses of brands failing to meet their guaranties are listed.

[Experiments with beef cattle at the Virginia Station] (*Virginia Sta. Rpt. 1926–1927, pp. 72, 73, 149–154*).—Results of two studies are noted.

Winter yearling spayed heifers, C. R. Nobles.—A comparison of dry roughage and corn silage for wintering beef heifers was made with 2 lots of 13 and 14 head, respectively, averaging 797 and 787 lbs. per head. Lot 1 received an average ration of 10.17 lbs. of mixed hay, 6 lbs. of corn stover, and all the wheat straw they would consume. Lot 2 received 29.12 lbs. of corn silage, 2.7 lbs. of mixed hay, 2.06 lbs. of corn stover, and all the wheat straw they would eat. During a 100-day period from January 15 to April 25, 1924, the heifers in lot 1 made an average gain of 1.53 lbs. per head, while lot 2 gained 17.14 lbs. per head. The cost of wintering was slightly higher in lot 2 than in lot 1.

On pasture from April 25 to October 17, lot 1 made an average daily gain of 2.07 lbs. per head, while lot 2 gained at the rate of 1.95 lbs. per head daily.

Winter fattening of steers, R. E. Hunt.—An experiment to determine the advisability of using corn stover silage instead of corn silage and the substitution of molasses for corn in the ration for fattening steers was begun during the winter of 1920–21 and continued for the two subsequent winters. The first two studies were conducted with yearling steers and the third with calves. The feeds used were corn, molasses, cottonseed meal, corn silage, corn stover silage, and hay fed in varying amounts. Molasses was fed only in the first trial and hay in the third.

For yearling steers it was found that 3 lbs. of molasses produced gains equal to those produced by 2 lbs. of corn. Corn stover silage proved an economical feed for fattening cattle when compared with corn silage, especially when shelled corn was high priced. With a ration of corn and corn silage for yearling steers 1 lb. of cottonseed meal was more economical than larger amounts. For yearling steers a ration of 8 lbs. of corn, 1 lb. of cottonseed meal, and 25 lbs. of silage was not sufficient to put a good finish on the cattle. A very satisfactory ration for finishing calves was composed of 4 lbs. of hay, 8 lbs. of corn silage, 3 lbs. of cottonseed meal, and 1 lb. of corn, gradually increased to a full feed. A protein supplement was found necessary for feeding calves.

Cane molasses for finishing calves, C. C. Culbertson, J. M. Evvard, W. E. Hammond, and C. F. Bassett (*Iowa Sta. Leaflet 27 (1929), pp. 8*).—To determine the economy of adding cane molasses, hand-fed or self-fed, to a standard Corn Belt ration in the finishing of calves, two tests were conducted using 2 lots of 5 calves each in each trial. The average weight per head was 436 lbs. in the first test and 381 lbs. in the second test. The feeding periods were of 270 and 240 days duration, respectively. The check ration in the first test consisted of shelled corn, linseed meal, alfalfa hay, and salt, to which was added in the test lot after 150 days of feeding 1 lb. of cane molasses per head daily. In the second study the check ration was similar to the above except that corn silage and minerals were added and the experimental lot was self-fed cane molasses in addition to this ration after 150 days of feeding.

In neither case did the addition of cane molasses increase the rate of gains. The check lots made average daily gains of 2.42 and 2.32 lbs. per head, while the test lots made 2.38 and 2.31 lbs. per head, respectively. Calves fed molasses required more feed per unit of gain, and even after crediting the feed saved by the hogs the feed cost per 100 lbs. of gain was higher than in the lots receiving no molasses. In both tests the hogs following the molasses-fed calves saved more corn and corn equivalent than those following the check groups. There was little difference in the finish of the lots. From the results obtained it was evident that adding cane molasses to a standard Corn Belt ration was not economical unless it could be purchased for considerably less per ton than shelled corn.

Beef production on the farm, W. H. Black and E. W. McComas (*U. S. Dept. Agr., Farmers' Bul. 1592 (1929), pp. II+14, figs. 9*).—This publication supersedes Farmers' Bulletin 1073 (E. S. R., 42, p. 264).

Dehorning, castrating, branding, and marking beef cattle, W. H. Black and V. V. Parr (*U. S. Dept. Agr., Farmers' Bul. 1600 (1929), pp. II+12, figs. 11*).—This is a revision of and supersedes Farmers' Bulletin 949 (E. S. R., 39, p. 290). Information has been added on the branding and marking of cattle.

The use of dressed-beef appraisals in measuring the market desirability of beef cattle, J. L. Lush, W. H. Black, and A. T. Semple (*Jour. Agr. Research [U. S.], 39 (1929), No. 2, pp. 147–162*).—In this article the authors discuss and illustrate a simple, inexpensive method of expressing in a single figure the market desirability of a beef carcass. After the carcasses have been in the cooler for at least 24 hours, men regularly employed in selling meat

to retailers make independent estimation of the price they think each carcass would sell for. The probable error of the accuracy of this average appraisal value was found to be about 3.4 cts. per 100 lbs. of dressed meat on a single-lot basis and about 3.7 cts. per 100 lbs. of dressed meat on the basis of an entire shipment.

This method is inexpensive and makes it possible to express the results on the basis of live-weight prices. It does not, however, give any indication of the reason for the appraisal values being high or low.

Feedlot fattening rations for lambs, E. J. Maynard and H. B. Osland (*Colorado Sta. Press Bul. 68 (1929), pp. 8, fig. 1*).—Continuing the lamb feeding studies (E. S. R., 59, p. 663), grade range lambs were divided into 11 lots of 25 head each, averaging approximately 62.5 lbs. per head with the exception of 1 lot which averaged 41.5 lbs. per head. The feeding schedule was the same as in the previous test except that in this study No. 2 grade barley was fed instead of Trebi barley and No. 3 grade barley instead of Coast barley. The feeding period was of 122 days duration. The average daily gains in this study were 0.26, 0.25, 0.25, 0.26, 0.26, 0.3, 0.29, 0.33, 0.28, 0.32, and 0.24 lb. per head, respectively.

Based on the results of the two studies, No. 2 grade barley had 89.4 per cent the feeding value of shelled corn, No. 3 grade barley 83.5 per cent, and steamed-rolled barley 86.7 per cent. A ton of cottonseed meal replaced 1,842.9 lbs. of No. 2 grade barley and 1,667.6 lbs. of alfalfa hay. Each ton of cut corn fodder replaced 162.5 lbs. of barley, 2,275.2 lbs. of alfalfa, and 9.8 lbs. of cottonseed meal, while a ton of corn silage replaced 1,036.7 tons of alfalfa, but required 1.6 lbs. more barley and 1.8 lbs. more cottonseed meal. In this study corn silage had 41.2 per cent the feeding value of cut corn fodder. A ton of pressed beet pulp replaced 106 lbs. of barley, 690.1 lbs. of alfalfa, and 25.9 lbs. of cottonseed meal.

Lambs fed alfalfa hay in self-feeders made more economical gains than those fed hay through panels, requiring less corn and hay per unit of gain. The feed cost for the light weight lambs was 87.5 per cent less than for medium weight lambs. However, the selling price per hundredweight was less for the light weight lambs, and for the two tests the purchased price of these lambs had to be 50 cts. less per hundredweight than for medium weight lambs in order to return the same profit.

Experiments in pasturing dry-land crops with hogs [at the Huntley, Mont., Field Station], A. E. Seamans (*U. S. Dept. Agr. Circ. 70 (1929), pp. 27–31, fig. 1*).—Continuing these studies (E. S. R., 55, p. 161), 15 spring pigs averaging 46 lbs. per head in 1925 and 37 lbs. in 1926 were placed on an acre of spring wheat and oats and oats alone in the respective years. The pigs were fed a supplementary ration of shelled corn. A check lot of pigs were fed in dry lot on corn and skim milk. Pasturing was started on June 5 and 9 and the pigs were on pasture for 42 and 28 days, respectively. During this period they made average daily gains of 0.76 and 0.66 lb. per head, and the corn replaced per acre of pasture as compared to the consumption in dry lot was —331 and 39 lbs., respectively. Following this period the pigs were turned on peas for 14 days each year and made average daily gains of 0.83 and 0.74 lb. per head, and the corn replaced per acre was —38 and 73 lbs. in the respective lots. After the peas were cleaned up the pigs were turned on Sudan grass and soybeans, 1 acre in 1925 and 0.5 acre in 1926. This pasture furnished feed for 28 and 14 days, produced average daily gains of 0.83 and 0.87 lb. per head, and replaced 414 and 392 lbs. of corn. In 1926 the pigs were transferred to 0.5 acre of sorgo and soybeans for 14 days, on which they made 0.76 lb. average daily gain and which replaced 490 lbs. of corn. Corn was used to finish the pigs

both seasons, 1 acre furnishing 10 days of feed in 1925 and 14 days in 1926. The pigs made daily gains of 0.69 and 0.85 lb. per head, and each acre saved 342 and —39 lbs. of corn in the respective years.

Alfalfa and bromegrass sown in rows or broadcasted were pastured with fall pigs receiving a 3 per cent shelled corn supplementary ration in 1925 and 1926. Three pigs were pastured on 0.5-acre plats in each year. The grazing period was 70 days on each type of pasture in 1925 and 41 days in 1926. The pigs on alfalfa sown in rows made average daily gains of 1.5 and 1.56 lbs. per head, as compared with 1.31 and 1.46 lbs. in the respective years for those on alfalfa broadcasted. The corresponding gains in the bromegrass lots were 1.21 and 1.19 and 1.07 and 1.26 lbs. per head daily. On the basis of the results obtained in a check lot fed skim milk and corn, it was calculated the following amounts of grain were replaced per acre of pasture in 1925: By alfalfa sown in rows 473 lbs., alfalfa broadcasted 193 lbs., bromegrass in rows 56 lbs., and bromegrass broadcasted 152 lbs. No check lot was used in 1926 due to a shortage of hogs.

Crop-utilization experiments [at the Huntley, Mont., Field Station], D. A. Savage (*U. S. Dept. Agr. Circ. 70* (*1929*), *pp. 31–36*).—The results of swine feeding tests in continuation of those previously noted (E. S. R., 55, p. 161) are reported.

Pasturing alfalfa with hogs.—Combined results in this study from 1914 to 1926 show that fall pigs receiving a 2 per cent corn ration in addition to the pasture made average daily gains of 0.94 lb. per head and consumed 318 lbs. of corn for each 100 lbs. of gain. Spring pigs similarly fed gained at the rate of 0.49 lb. per head daily and required 253 lbs. of corn in addition to the pasture for 100 lbs. of gain. Calculated to an acre basis, spring-pastured alfalfa in two 6-year rotations was equivalent to 1,312 and 1,256 lbs. of grain, respectively, while summer-pastured alfalfa in the same rotations replaced 2,017 and 1,696 lbs. of grain.

Hogging off corn.—The results of 15 tests from 1912 to 1926 in hogging off corn by pigs that had been on summer alfalfa pasture in the above test showed that an average gain of 710 lbs. per acre was made. It was estimated that these pigs required 471 lbs. of corn for each 100 lbs. of gain.

Hogging off corn and rape.—Results of 11 tests from 1916 to 1926 in hogging off corn and rape showed that the pigs made an average gain of 793 lbs. per acre and consumed 405 lbs. of corn per 100 lbs. of gain.

Hogging corn alone compared with hogging corn and rape.—It was found that 83 lbs. more pork per acre was produced when rape was grown with corn than from corn alone. An average daily gain of 1.35 lbs. per head was obtained on corn alone and 1.37 lbs. on corn and rape.

In 1925 an additional test was made in hogging down 3 acres of Payne White corn, with an estimated yield of 40 bu. per acre. During a period of 46 days 24 pigs averaging 182 lbs. initial weight made an average gain of 60 lbs. per head and required 465 lbs. of grain per 100 lbs. of gain.

[Experiments with swine at the New Jersey Stations] (*New Jersey Stas. Rpt. 1928, pp. 30–32*).—The results of two studies are noted.

The effect of commercial gelatin on the growth of young pigs.—In this work 4 lots of 2 pigs each averaging approximately 55 lbs. per head were fed for 77 days as follows: Lot 1 corn and tankage, lot 2 corn and gelatin, lot 3 corn, wheat middlings, and gelatin, and lot 4 corn, tankage, and gelatin. Lots 2 and 3 after 42 days on feed lost their appetites and became almost completely paralyzed. In lot 1 the pigs gained 99.8 lbs. and in lot 4 105 lbs. per animal during the feeding period. These results indicate that gelatin can not replace

animal protein in the ration of pigs and does not seem to increase the efficiency of tne usual ration.

[*The effect of fish meal and tankage on the growth of swine*].—For each 100 lbs. of gain pigs fed corn supplemented with fish meal required 359 lbs. of feed, while those receiving tankage instead of fish meal required 402 lbs. of feed. Pigs in the first lot gained at the rate of 1.48 lbs. and those in the second lot 1.33 lbs. per head daily.

[**Experiments with swine at the North Carolina Station**] (*North Carolina Sta. Rpt. 1928, pp. 47–49, 50, 52, 53, fig. 1*).—Results of experiments, most of which are continuations of earlier work (E. S. R., 59, p. 767), are noted.

Value of permanent pasture for fattening pigs, E. H. Hostetler and J.O. Halverson.—Pigs averaging 42 lbs. per head were divided into 3 lots of 15 head each and fed a mixture of corn meal, wheat shorts, fish meal, and minerals. The protein content of the ration was decreased as the pigs increased in live weight. Lot 1 was fed in dry lot and lots 2 and 3 on orchard grass pasture, but in the latter lot only half as much shorts and fish meal was fed as in the other lots. Death losses of 5 pigs in lot 1, 3 in lot 2, and 4 in lot 3 made the results somewhat unsatisfactory. The average daily gains in the respective lots were 1.23, 1.25, and 1.2 lbs. per head, and for each 100 lbs. of gain the respective lots required 362, 363, and 375 lbs. of feed.

Cottonseed meal for fattening pigs, R. E. Nance.—The rate of gain, feed consumption, and cost of gain were practically the same in 2 lots of pigs, 1 of which received shelled corn, fish meal, and minerals and the other fish meal and cottonseed meal, equal parts, instead of fish meal alone. In the latter lot, 26 pigs were fed the cottonseed-meal supplement for 153 days without any apparent harm.

Whale meal as a supplement to corn for fattening pigs, R. E. Nance.—Shelled corn and minerals were fed to 2 lots of 8 pigs each averaging approximately 100 lbs. per head. In addition lot 1 received fish meal and lot 2 whale meal as protein supplements. The average daily gains were 2.04 and 1.28 lbs. per head in the respective lots. Lot 1 required approximately 100 lbs. less feed to produce 100 lbs. of gain than did lot 2. Both lots consumed about the same amount of protein supplement, but lot 2 ate 3.7 times as much mineral and 153 lbs. less corn than lot 1.

Comparison of protein supplements and minerals for fattening pigs.—Four groups of 15 pigs each were self-fed corn, fish meal, and minerals. In group 3 ground soybean hay and in group 4 ground alfalfa hay replaced one-fourth of the fish meal. The mineral mixture was composed of 10 lbs. of ground dolomitic limestone (except in lot 2, which received calcitic limestone), 10 lbs. of superphosphate, and 2 lbs. of salt. The average daily gains in the respective lots were 2.36, 2.54, 2.31, and 2.4 lbs. per head, while the feed required per 100 lbs. of gain was 371, 356, 391, and 368 lbs. in the respective groups.

Hogging down corn.—On 3 acres of standing corn 66 pigs averaging 41 lbs. per head and self-fed fish meal and mineral in addition gained 640 lbs. of pork per acre. The estimated yield was 29.7 bu. of corn per acre, and the 3 acres furnished feed for the pigs for 32 days.

Hogging down immature corn.—For hogging down immature corn 66 pigs were turned in an 11.85-acre field when the corn was in the dough stage. They were self-fed fish meal and minerals as supplements. It required 48 lbs. of fish meal, 7.6 lbs. of minerals, and 1 acre of corn to produce 283 lbs. of gain.

A study of the utilization of crops, grown in rotation, by two different methods.—Two acres of corn in a 3-year rotation of corn, cotton, and soybeans were hogged off, while 1 acre was cut as a check. The hogged-off area pro-

duced 740 lbs. of gain on 8 pigs, which in addition consumed 241 lbs of fish meal and 77 lbs. of mineral. The check lot produced 1,710 lbs. of corn in the shuck.

Hogging-off peas and corn, 1928, E. G. SCHOLLANDER (*North Dakota Sta. Bul. 227 (1929), pp. 32–34, figs. 2*).—This study has been continued (E. S. R., 60, p. 69) using a 1.13-acre field for field peas and a 1.19-acre field for Howes Alberta flint corn. Seven pigs averaging 101.7 lbs. per head were turned into the peas on August 16, 103 days after seeding, and during the 33 days it required to consume the peas made an average daily gain of 1.33 lbs. per head. On September 18 the pigs, averaging 145.7 lbs. per head, were turned in the cornfield and during the next 50 days made an average daily gain of 1.84 lbs. per head. A small amount of skim milk was fed daily throughout the test.

For the entire period the pigs made an average of 410.8 lbs. of pork gain per acre, an average daily gain of 1.64 lbs. per head, and a gross return of $40.01 per acre. Approximately 305 gal. of skim milk were fed during the experimental period, and when this was charged at 25 cts. per 100, a net return of $37.38 per acre was obtained for the peas and corn not considering the labor or the rent on the land.

Type in swine as related to rate and economy of gain and quality of pork, S. BULL and W. E. CARROLL (*Illinois Sta. Circ. 345 (1929), pp. 14, figs. 14*).—This is an abstract of Bulletins 321, 322, and 323 (E. S. R., 61, p 460), in which the most popular findings are brought together.

[Poultry studies at the Michigan Station] (*Michigan Sta. [Bien.] Rpt. 1927–28, p. 25*).—The results of two studies are noted.

Some factors influencing the hatchability of eggs.—A marked correlation between egg weight and hatchability has been shown in a series of tests. Chicks from the larger eggs were also found to weigh correspondingly more than those from small eggs. These results led to the recommendation that eggs weighing less than 22 oz. per dozen be discarded for hatching purposes.

Exposing for 15 minutes daily to ultra-violet light during the first 19 days of incubation did not improve the hatchability of eggs. Negative results were also obtained in tests in which eggs were dipped or sprayed with disinfectants (E. S. R., 60, p. 470).

Powdered buttermilk in the treatment for coccidiosis.—Powdered buttermilk was found valuable for preventing the check in development of chicks affected with coccidiosis. It also aided in the recovery of birds already infected.

[Poultry experiments at the New Jersey Stations] (*New Jersey Stas. Rpt. 1928, pp. 12–15*).—The results of three experiments are noted.

A study of the value of the glass substitute, Cel-O-Glass, as a medium for the passage of physiologically active ultra-violet radiations.—Chicks exposed to direct sunlight for an average of 4.5 minutes daily were found by O. N. Massengale and C. H. Howard to have as much ash in their bones as chicks exposed for 15 minutes to ultra-violet light. About three times as much radiation is required by chicks when ultra-violet light is filtered through a glass substitute as when the chicks are exposed to the direct rays of the sun.

A single exposure of 45 minutes to the rays of a quartz mercury lamp was effective for 1 week for preventing leg weakness in chicks, while 90 minutes' exposure was effective for 2 weeks. Longer exposures did not prolong the effect. Cel-O-Glass that had been exposed to the weather for 1 year was still effective for transmitting the ultra-violet light of winter sunshine. Chicks raised to 8 weeks of age on a leg weakness-producing ration in a house the entire front of which was made of Cel-O-Glass showed no signs of leg weakness, and the bone formation was normal.

Ergosterol exposed to the 3,130 angstrom wave length was effective for curing rickets, although not as effective as that exposed to the 3,025 angstrom wave length. These results are significant since the intensity of the 3,130 angstrom wave length of winter sunlight is not diminished as much as the 3,025 angstrom wave length.

A study of the value of calcium citrate in the nutrition of farm animals.—Calcium balance studies by F. G. McDonald indicated that laying and nonlaying pullets utilized the calcium from calcium citrate as well as that from calcium carbonate. The breaking strength of the shells and the grades of eggs produced were the same in the lots receiving these calcium supplements.

The formation and function of the antirachitic factor in the chicken.—In a cooperative study with Columbia University, it was found that excluding the antirachitic factor from a hen's diet decreased egg production and also the amount of the factor found in the egg. The eggs produced by such hens failed to hatch. Vitamin D was found to be entirely lacking in the livers and bodies of newly-hatched chicks, and the failure of eggs from hens on an antirachitic-free diet to hatch may be due to the lack of development of the embryo.

[Poultry experiments at the North Carolina Station], B. F. Kaupp (*North Carolina Sta. Rpt. 1928, pp. 82, 83*).—The results of two experiments (E. S. R., 59, p. 769) are reported.

Influence of meat meal v. milk in chick development.—Chicks receiving milk as the sole source of animal feed grew more rapidly, were more vigorous, and fewer chicks were underdeveloped than similar chicks fed meat meal. Up to 6 weeks of age only 9 of 216 chicks had died, while 38 of 184 fed meat meal were dead. For the first 4 weeks the mortality rate was 11.4 per cent in the milk lot and 20.6 per cent in the meat meal lot.

Pullets fed milk tended to lay earlier, to be heavier, and to have shorter lives than those fed meat meal.

Vitamin experiments.—Cod-liver oil has been found to increase the fertility and hatchability of eggs. This vitamin supplement had a more marked stimulating effect on the health and development of birds fed meat meal than on the milk-fed flock. Mineral supplements fortified with cod-liver oil improved the health of the flock as measured by production, mortality, condition of plumage, fertility, hatchability, and resistance to disease.

Two lots of 400 Leghorns were fed the same ration except that one lot received dried orange peel and pulp in the mash. Green feed was supplied both lots to the middle of January. At this time the green feed was discontinued and a like amount of white mangels substituted. The hens receiving orange pulp maintained their egg production, while in the other lot production decreased 5 per cent.

Rules and regulations for the sixth Utah intermountain egg-laying contest, B. Alder (*Utah Sta. Circ. 79 (1929), pp. 4, fig. 1*).—General information and rules for the sixth Utah intermountain egg-laying content (E. S. R., 59, p. 870).

DAIRY FARMING—DAIRYING

[Experiments with dairy cattle at the New Jersey Stations] (*New Jersey Stas. Rpt. 1928, pp. 13, 14, 116–122, 123*).—Several studies are briefly noted.

A study of the value of calcium citrate in the nutrition of farm animals.—It was found by F. G. McDonald that calcium citrate when fed to cows did not change the calcium or phosphorus content of the milk or blood, but caused a slight increase in the citrate-ion content of the milk. Feeding this mineral did not change the rate of milk production.

The effect of nitrogenous fertilization on the protein content of corn and the feeding value of the whole plant when ensiled, C. B. Bender.—The first year's results in this study indicate that the nitrogen content of silage is not affected by the amount of nitrogen fertilizers used on the land on which the corn was grown. The only noticeable difference was in the yield of corn per acre.

Influence of flaxseed and cottonseed meal on the quantity and quality of cows' milk, C. B. Bender.—In this study cows were tested according to the usual two-day semiofficial test, and this was immediately followed by the "jockey test," in which from 6 to 10 lbs. of flaxseed or cottonseed meal was substituted for part of the test ration. Of the 6 cows fed flaxseed, all increased in fat percentage, the range of increase varying from 0.028 to 0.28 per cent. When 4 of these cows were fed cottonseed meal, the fat percentage decreased in all cases, the range being from —0.001 to —0.277 per cent. These differences in fat production could not be detected by variations in milk production, since the latter varied in individual cases.

The effect of temperature and humidity on the milk production of dairy cows, C. B. Bender.—Continuing this study (E. S. R., 57, p. 73) in cooperation with the Walker-Gordon Laboratories, it was found that humidity, not temperature, apparently affects milk production. The effect is not direct, but causes the animals to go off feed. A humidity range between 50 and 75 appeared to be normal for dairy cows. High-producing animals were apparently more susceptible to humidity variations than low-producing animals.

Effect of nitrogen fertilization on the carrying capacity of pastures, C. B. Bender.—Seven pasture plats containing 3.795 acres each were used in this study. Each plat was top-dressed with 1,000 lbs. of lime per acre. The first 6 plats received superphosphate and muriate of potash at the rate of 300 lbs. each per acre. Sulfate of ammonia was applied to the first 5 plats at the rate of 100, 200, 300, 400, and 500 lbs. per acre, respectively. On July 7, 10 calves, 24 yearlings and dry cows, and 52 milking cows and springers were turned on the plats, and the carrying capacity of each was recorded in cow days per acre per season of 165 days. Figuring calves from 6 to 12 months old as one-half a unit, the carrying capacities for the respective plats were 1.15, 1.05, 1.1, 1.11, 0.97, 0.518, and 0.581 cows per acre. The results obtained from the various treatments are deemed difficult to explain except to show that pasture treatment increases its carrying capacity.

Grain losses in feeding corn silage to dairy cows, R. B. Becker and W. D. Gallup (*Jour. Agr. Research* [*U. S.*], *39* (*1929*), *No. 3*, *pp. 223–227*).—Following the same procedure as in a previous study (E. S. R., 58, p. 269), four cows were fed a daily ration of 30 lbs. of corn silage and 10 lbs. of alfalfa hay per 1,000 lbs. live weight through a 10-day preliminary and a 10-day experimental period. In addition, they received a mixed grain ration of wheat bran, ground oats, corn meal, and cottonseed meal. Samples of the ea rcorn at the time of filling the silo and of corn kernels separated from the silage and from the manure were air dried, weighed, and analyzed.

It was found that 8.47 per cent by weight of the corn kernels in the silage were voided in the feces. Of the whole kernels in the silage only 4.36 per cent were recovered as whole kernels from the manure. Analyses of the corn kernels of silage which passed through the cow's digestive tract showed slight losses of protein, ether extract, and ash. The kernels voided in the feces were calculated to contain 5.22 per cent of the digestible crude protein and 5.26 per cent of the total digestible nutrients in the corn silage.

Dairy herd improvement through the use of proved bulls, F. W. Atkeson, H. A. Mathiesen, and D. L. Fourt (*Idaho Sta. Bul. 163 (1929), pp. 23, figs. 7*).—A study of 3,700 Idaho cows with dairy herd improvement records showed that cows producing 200 lbs. of butterfat returned twice as much profit as those producing 150 lbs., that a 400-lb butterfat cow was equal to five 150-lb cows, and that a 500-lb. butterfat cow was equal to seven 150-lb. cows. A survey of 25 bulls showed that only 48 per cent were purebred, but that the farmers with the purebred bulls sold 27 lbs. more butterfat annually per cow than did other farmers.

The daughters of 76 proved sires produced 7 per cent more milk and 8.6 per cent more fat than did their dams. An increased production in daughters as compared with the original cows was produced by 71 per cent of these bulls. All of the bulls, when mated with cows averaging 322 lbs. of fat or less, caused an increase in production, but as the records of the original cows became higher fewer of the bulls were able to increase the production of their daughters.

These results with proved bulls indicate the undependability of unproved sires for increasing the average production of a herd.

Electrical conductivity of milk and the external medium [trans title], S. S. Perov (Peroff) (*Trudy Vologodsk. Moloch. Khoz. Inst. (Arb. Milchw. Inst. Wologda) (Bûl. 72 (1928), pp. 5–44)*).—Continuing these studies at the Vologda Dairy Institute (E. S. R., 59, p. 874), a series of experiments was conducted to determine the various factors that influence the electrical conductivity of milk. The conductivity was found to vary from a minimum of 34 to a maximum of 54. In general the variance was greater between individuals than between herds of cattle.

The specific conductivity of the milk of six cows was measured throughout the entire lactation period. The variations for the individuals did not exceed those of the combined milk from all the cows. It was found that the mean conductivity of evening milking was slightly higher than that of morning milking, indicating a higher salt content in the evening milk. The milk from the various breeds of cattle studied also showed differences in conductivity.

In general it was found that low conductivity was due to a large proportion of solids containing no ash at an average ash content or to a low ash content with an average proportion of total solids. On the other hand, a high conductivity was due to a reversal of the above factors.

The importance of dry milk cans, H. H. Sommer and B. W. Sarles (*Milk Dealer, 18 (1929), No. 11, pp. 60, 61, 96*).—The condition of milk cans as they leave the washing machine as a possible source of bacterial contamination of milk was the object of this study at the Wisconsin Experiment Station. Cans washed in three different makes of can washers were studied. After the can came from the washer, samples for bacterial counts were obtained by placing 1 liter of sterile water in the can, putting the lid on tight, and shaking the can vigorously in a horizontal position. A sample of water was then drawn from the can, plated on suitable position, incubated for 48 hours, and the number of bacteria in the can computed. Additional samples were taken from cans after they had stood for 24 or 48 hours at room temperature with the lids on.

The cans from the first washer were clean and hot on leaving the machine, but were quite wet when they had cooled, due mainly to steam and hot, moist air left in the can. It was estimated that immediately after washing 20 cans contained on an average enough bacteria per can to raise the count of milk only 1.5 bacteria per cubic centimeter. However, after standing 24 hours 33 new cans from this washer had enough bacteria to raise the count of milk 13,360 per cubic centimeter, and 42 old cans 40,813 per cubic centimeter. The

from the second washer were very clean, hot, and dry on leaving the :r, and 7 cans contained only enough bacteria to raise the count of milk han one organism per cubic centimeter. Even after 38 cans had stood 4 hours the bacteria had increased only to a point where the bacterial of milk was raised 17 bacteria per cubic centimeter. The cans came the third washer in much the same condition as from the first. An ge of 12 cans tightly closed and examined after 48 hours showed bac- equivalent to a milk contamination of 8,691 bacteria per cubic centimeter. se results show the importance of dry cans for reducing bacterial con- ation.

:periments with dairy products at the New Jersey Stations], F. C.)N (*New Jersey Stas. Rpt. 1928, pp. 35, 116*).—Several experiments are y noted.

antirachitic value of irradiated ice cream.—Ice cream that had been ated with ultra-violet light cured the rachitic condition of rats, while eam from the same batch fed at the same level but not irradiated had aling effect. The temperature at the time of irradiation did not affect the ty of the mix for short periods, nor did freezing and low storage tempera- affect the antirachitic value of the cream for several months.

; use of dehydrated egg products in the manufacture of ice cream.—The f dried egg yolks increased the whipping properties and decreased the ng time of an ice cream mix. The texture of the mix, but not the sta- . was improved by the use of this product, but using more than 1 per cent ın unfavorable effect upon the flavor. Dried whole egg was nearly as .ve in the above respects as dried yolks, but dried egg albumin was det- tal. All of the egg products increased the apparent viscosity of a mix, .creased the basic viscosity only slightly.

: effect of viscolization on the wheying-off properties of cultured skim and buttermilk.—Unless 1 per cent of fat was present, it was found that izing skim milk increased the amount of whey separation except when :olizing temperature above 155° F. was used. Viscolizing cultured butter- :aused a marked separation of serum. Gelatin was not found necessary :vent wheying off in the preparation of good quality buttermilk, especially the milk was pasteurized at temperatures above 155°.

:sh unripened cheese is prepared from skim milk, K. WINKLER (*But- ıd Cheese Jour., 20 (1929), No. 21, pp. 16, 18, 20*).—In this article the r describes the manufacture of several kinds of fresh cheese in use in ent European countries.

cosity in ice cream mixes, H. F. DEPEW (*New Hampshire Sta. Tech. 38 (1928), pp. 16, fig. 1*).—In addition to the findings previously noted this study (E. S. R., 61, p. 171), it was shown that mixes containing er cent solids had considerably more viscosity under the same condi- than mixes with a 33.5 per cent solids content. The low solids mixes orated air more easily and had a higher maximum overrun than the solids mixes, but were not stable enough to retain that overrun when r agitated in the freezer. Agitation of the mix previous to freezing ed in a decrease in apparent viscosity, but did not affect overrun or ıse of obtaining it. Highly viscous mixes incorporated overrun more ' and in smaller amounts than less viscous mixes. Extremes in viscosity o different homogenizing pressures resulted in noticeable differences ; texture of the finished product. From the standpoint of improved 'e, increasing viscosity above the optimum for ease in handling the mix btaining overrun was not justified.

VETERINARY MEDICINE

[Work in animal pathology and bacteriology at the Michigan Station] (*Michigan Sta. [Bien.] Rpt. 1927–28, pp. 7, 8*).—Particular reference is made to a series of studies of infectious abortion, reports of which have been noted. Brief mention is made of a study on the nutritional disorders of cattle fed on variously altered diets, a more or less constant feature of which has been lesions of the liver and kidneys and evidences of acute gastrointestinal intoxications. Reference is made to the use of colloidal iodine for certain animal parasites, reports upon which have been noted. The one-tube agglutination test for bacillary white diarrhea, using a dilution of 1 to 50, was found to save labor and material and to have a high degree of accuracy.

Investigations conducted in the department of zoology and animal pathology, R. A. Runnells (*Virginia Sta. Rpt. 1920–1927, pp. 75, 76*).—This is a brief report of work conducted since the work of the department was commenced August 1, 1924. Particular reference is made to bacillary white diarrhea, work with which is reported upon in Bulletin 265, previously noted (E. S. R., 61, p. 677).

In work conducted in 1928 with anthelmintics, over 60 birds were used. Kamala was found to be effective for tapeworms and nicotine sulfate for roundworms, but when combined they removed neither roundworms nor tapeworms.

Control of stomach worms in sheep by drenching, R. H. Ruffner (*North Carolina Sta. Rpt. 1928, p. 53*).—Two groups of five lambs each at the Piedmont Substation were cared for in the same way except that one group was drenched with copper sulfate solution monthly from August 1 to November 12, 1927. The lambs in the drenched lot made more gain than those in the undrenched lot and were in a more thrifty condition at the close of the experiment.

Scours in sheep and goats in Oregon, J. N. Shaw (*Oregon Sta. Circ. 93 (1929), pp. 16, figs. 13*).—Scours in sheep and goats is said to be an important problem in Oregon, where it is usually the result of infestation with worms. Small stomach worms (*Ostertagia ostertagi* and *O. circumcincta*) and five intestinal worms (*Trichostrongylus vitrinus, T. extenuatus, T. instabilis, T. colubriformis,* and *Nematodirus filicollis*) are said to be very common. The hookworm *Bunostomum trigonocephalum* has been found quite common in a few bands of sheep. Three worms are usually present in the large intestine, *Chabertia ovina, Oesophagostomum venulosum,* and *Trichuris ovis.* The liver fluke (*Fasciola hepatica*) is also considered. Treatment, control, and eradication are taken up.

On the nature and cause of "the walking disease" of northwestern Nebraska (Necrobiosis et cirrhosis hepatis enzootica), L. Van Es, L. R. Cantwell, H. M. Martin, and J. Kramer (*Nebraska Sta. Research Bul. 43 (1929), pp. 47, pls. 5, figs. 10*).—This is a report of studies of a fatal disease of horses prevalent in certain parts of northwestern Nebraska which has become of economic importance since 1912, the losses caused by the disease on certain farms or ranches having been nothing short of ruinous. The disease is essentially an enzootic necrobiosis and cirrhosis of the liver due to a toxic agent and does not materially differ from similar disorders occurring in other regions or countries. The disease affects horses and less commonly, cattle.

The authors have found that in all its clinical and pathological manifestations it may be reproduced with the utmost fidelity by the feeding with plants of *Senecio riddellii.* "It was not possible to exculpate entirely the *S. integerrimus,* although no experimental evidence was obtained which would indicate that this plant is a factor in the causation of 'the walking disease.' Feeding

experiments showed that *Lupinus argenteus* and *L. plattensis* are harmless to horses. There is evidence, epizootic as well as pathologic, which tends to show that the poisoning by *S. riddellii* is limited to a relatively short period. Preventive measures may be based upon these observations. In these measures the use of sanctuary pastures during the critical season may have a definite place."

A list is given of 85 references to the literature.

Report of the poultry pathologist, F. R. Beaudette (*New Jersey Stas. Rpt. 1928, pp. 287–298, pl. 1*).—Experimental work conducted dealt with the diagnosis of poultry diseases occurring in the State, the relation of soil reaction to the viability of poultry disease organisms, a study of avian paratyphoid organisms, and an epidemiological study of fowl cholera (noted on page 770).

The fowl cholera organism inoculated into dry sterile soil samples of pH 4.4 to 7.0 was not found to be viable 3 days later. This result was confirmed by repeated tests. Similar samples inoculated with *Bacterium sanguinarium* yielded the organism 3 days later in samples as low as pH 6.2. After 8 days the organism could not be isolated from the soil samples of pH 6.2 or 6.4, but was isolated from soil samples of pH 6.7 and 7.0. After 18 days the result was no different, but after 40 days the organism was recovered only from the soil sample of pH 7.0. The organism was still viable in soil of pH 7.0 after 64 days. These results are said to confirm the findings of the preceding year.

In similar tests with *B. pullorum*, the organism grew when tested 3 days after its inoculation into soil samples from 6.4 to 7.0. Under these conditions the organism shows a slightly greater susceptibility in acid soils than does *B. sanguinarium*. After 8 days the organism could not be cultivated from any soil sample except that of pH 7.0, and in this it was still viable after 64 days. When 0.3 cc. of sterile distilled water was added to each gram of soil, the viability of the white diarrhea organism was increased and the organism maintained itself in soils of a lower pH. After 3 days the organism could be isolated from soil samples between pH 5.2 and 7.0, and after 8 days it could be recovered from soil samples between pH 6.2 and 7.0. The addition of sterile water to the soil samples inoculated with the cholera organism did not change the results obtained with dry soils.

Of considerable importance is the finding of an avian paratyphoid organism in a brown creeper, indicating that wild birds may possibly serve in spreading the infection from one plant to another. Recently an epidemic in goslings was found to be caused by this organism. Up to the present time this organism has not been found in wild birds, turkeys, or geese. From the results obtained during the past two years it is evident that its occurrence is on the increase. When the disease once makes its appearance on a squab farm it apparently can not be eradicated. The evidence at hand suggests that adult birds serve as carriers of infection.

Observations made during the year indicate that confined birds must not be crowded, that the quarters must be cleaned frequently to control coccidiosis and blackhead, and that a screened porch is necessary to allow an ample supply of sunshine. Five birds reared in confinement to 8 weeks of age were confined by means of a 2-in. mesh wire to a concrete slab 8 in. above the ground on premises known to be infested with tapeworms. Of these, 1 died and the remaining 4 were autopsied after 10 weeks, 1 of the 4 living birds having been found free of parasites, while the remaining 3 showed 1, 150, and 75 tapeworms, respectively, representing two species. Neither ascarids nor heterakids were found in any of the birds. A similar lot of birds confined in a cage having insect-proof sides and top, but with a false bottom so that the birds had access to the soil, and moved from time to time to a new area, were

also examined after a 10-weeks period. One was not infested, but the remaining 4 showed 350, 1, 75, and 300 tapeworms, respectively, representing two species. Neither ascarids nor heterakids were found.

Pasteurella avisepticum infection of poultry, L. T. WEBSTER, T. P. HUGHES, I. W. PRITCHETT, and F. R. BEAUDETTE (*Soc. Expt. Biol. and Med. Proc., 25 (1927), No. 2, pp. 119–121*).—In this joint contribution from the Rockefeller Institute for Medical Research and the New Jersey Experiment Stations, the authors report upon experiments conducted with a view to determining whether respiratory infection with *P. avisepticum* takes place. The work was suggested by the similarity of this organism to *Bacterium lepisepticum*, the cause of most of the snuffles and pneumonias of rabbits.

The results obtained from infection experiments with chicks and grown fowls led to the conclusion that *P. avisepticum* is primarily the cause of a respiratory disease, with the local manifestations commonly known as roup, colds, etc., and the general pneumonia-septicemia phase recognized as fowl cholera. The endemic focus of infection is believed to be the "healthy" nasal carrier or roup—"cold"—case, and the organisms from these various types of clinical disease are considered to be essentially similar.

Poultry disease investigations, R. S. DEARSTYNE (*North Carolina Sta. Rpt. 1928, pp. 84, 85, 87*).—In immunity work with fowl typhoid, that produced by the single dose method of vaccination, using 1 cc. of vaccine, was studied on two groups of 21 birds each. In group 1 a commercial polyvalent vaccine was used and in group 2 a vaccine developed in the station laboratory. The general results indicated that the immunity established is of about equal degree. Antibodies which will agglutinate in a dilution of 1:100 are present in 24 hours. This is increased until at 72 hours after vaccination the antibody content is at its peak of concentration, agglutinating an antigen in a dilution of 1:200. Studies of the duration of this immunity are under way.

Work under way with bacillary white diarrhea included a study of the intermittent reactors to the agglutination test. Examination of the records of the State veterinarian's office has shown that of 11,195 birds tested twice, 6.8 per cent reacted on the second test after being negative on the first. There is said to be a basis for strong suspicion that the great majority of these birds were not intermittent reactors but were infected by ranging on ground which has been occupied by chicks suffering from the septicemic form of the disease.

Agglutination tests made every 14 days on the station's infected flock for a period of 11 months revealed a great fluctuation of antibody content in the serum of the carrier birds, there being 12 of the 24 birds studied which could be classified as true intermittent reactors. The egg infection ratio of the infected flock varied from 2 per cent in March to 16.7 per cent in August. Of [illegible]80 fertile eggs from this flock, representing a fertility of 87.6 per cent, 587 contained dead embryos on the twenty-first day.

Studies of the chicks that hatched showed that in 50 to 60 days 14 of every [illegible]4 chicks had antibodies, in 60 to 70 days 6 of 12 showed antibodies, in 70 to [illegible]0 days 5 of 6, and from 80 to 90 days 7 of 12 showed antibodies. Of the 54 birds which were autopsied, 4 showed lesions of the disease, and the organism was recovered from 12.

A brief note is presented by H. S. Wilfong (p. 87) on 14 strains of the bacteriophage active against the avian typhoid organism, of which 8 were isolated from fecal material of birds under study. These strains had a virulence ranging from 1+ to 3+. Six strains were isolated from fecal material from various farms where avian typhoid had occurred.

Study of pullorum disease from a flock standpoint, R. S. DEARSTYNE, [illegible]. F. KAUPP, and H. S. WILFONG (*North Carolina Sta. Tech. Bul. 36 (1929)*,

pp. 53, figs. 8).—This is a report of studies made in 1928 of a flock starting with 25 pullets and 2 males and ending with 21 pullets and 2 males, 4 pullets having died during the year. The birds composing the flock had all been found by State inspectors to react to the agglutination test for pullorum disease. These fowls, which were of exceptionally good blood and good type, were purchased and placed in new modern quarters early in January and given every attention possible, being fed the standard North Carolina laying mash, scratch feed, and green feed during the available season, with cod-liver oil supplement when green feed could not be obtained.

An examination of the production of the 21 birds which completed the 12-months period shows a total of 3,500 eggs, with an average net value of $2.18 per bird. Eighteen of the 21 birds were profitable producers from an egg-laying standpoint, and it is noted that 2 of the 3 birds showing a loss were not from the flock of Rhode Island Reds which constituted the majority of the birds in the test. Five of the birds under test laid over 200 eggs, and the flock average was 167.

The rate of egg infection as determined by analysis of fresh eggs was 10.3 per cent of 2,706 eggs examined. From 969 eggs incubated during the months of February, March, and April, it was found that fertility was not materially affected, and that the influence of the disease is felt (1) in the excessive number of weakened germs which failed to develop; (2) in the hatchability of fertile eggs, which was 37.5 per cent; and (3) in the livability of hatched chicks. In this study the mortality due to *Salmonella pullorum* infection was 71.2 per cent. The agglutination test showed 59.3 per cent of the progeny to be positive 90 days after hatching. On autopsy 7.4 per cent showed well-defined lesions of the disease, and from 22.9 per cent *S. pullorum* was recovered.

Of 24 pullets raised from this flock all developed into reactors within 7 months, and 21 have since laid infected eggs. It was found that 73.5 per cent of 83 chicks raised from the flock showed pullorum antibodies within 4 months after hatching, indicating that this percentage of survivors of an outbreak may develop into reactors. The infected pullets studied reacted intermittently in the ratio of 3:1 up to the eighth month after hatching. It was found that in order to eliminate a majority of such reactors a dilution as low as 1 to 25 should be used. The intermittent feature of the test has a tendency to be lessened as the bird matures. Application of the agglutination test at 15-day intervals for 12 months on this flock showed 8 of 21 birds as constant reactors and 13 as reacting intermittently in the 24 tests. Infected eggs were delivered during periods of negative test, and it was apparent that a bird that is once a reactor is always a carrier. The season exerted no influence on the efficiency of the test.

Individual studies of 4 high-producing and 4 low-producing reactors brought out the fact that while all high producers are profitable from an egg production standpoint, they are a menace and unprofitable as breeders, and that the low producer is unprofitable both as a producer and as a breeder. It appears that hatchability of fertile eggs and livability of hatched chicks is much lower in a low-producing reactor than in a high producer, and the authors consider it probable that the low-producing reactor is a representative of the bird in which the disease is much better defined than in the high producer, and that the probable site of infection is the ovaries.

Inoculation experiments showed that the presence of immune bodies in the blood of carrier birds does not render any noticeable protection against avian typhoid despite the fact that cross agglutination exists between these two organisms and their respective antiserums. Such immune bodies, however,

exert a beneficial influence against a bacteremia by *S. pullorum*, the influence probably manifesting itself in the form of agglutination in vivo.

Prevention of intestinal worms in chickens, R. GRAHAM and E. C. McCULLOCH (*Illinois Sta. Circ. 344 (1929), pp. 15, figs. 11*).—This is a practical summary of information on roundworms and tapeworms, and means for their control.

AGRICULTURAL ENGINEERING

[Agricultural engineering investigations at the Michigan Station] (*Michigan Sta. [Bien.] Rpt. 1927–28, p. 5*).—Limited trials of the use of chromium plating on the wearing surfaces of tillage tools showed that the plating chips at the cutting edge and thus exposes the steel to weathering processes and to rust. It is concluded that present methods of chromium plating are not adapted to farm machinery.

Data are also briefly reported on a new marl excavating bucket, the harvester-combine in Michigan, and the farm use of electricity.

Progress and results of investigations in agricultural engineering, D. C. HEITSHU (*Virginia Sta. Rpt. 1920–1927, pp. 90–92*).—A brief review is given of the development and progress of research in agricultural engineering from 1922 to 1927. This includes work on farm power, drainage, soil erosion, and farm machinery.

A tractor-cultivating study indicated that double-point shovels in 4-shovel gangs are best for conditions found on the college farm, self-leveling gangs are essential for rolling topography, a master lift lever is desirable, a gang shift in connection with the steering gear may cause hard steering on a side hill, an irreversible steering gear with pivotal steering is desirable, the lateral stability of the tractor should be improved on side hills, the cultivator must be adaptable to various widths of rows, the cultivator shields should be improved, and the mounting and unmounting of the cultivator attachment should be simplified.

In studies of the combine this machine was found to be satisfactory, but needing a few changes to meet Virginia conditions. To cut the full length of straw, either to save it or to get all of the lodged grain, a shorter cutter-bar and greater separator capacity are required. Stouter reels are required, and other minor mechanical changes are necessary to make the combine fully meet the needs of the State.

The combine proved to be the best soybean harvester now available, with an average loss of 11.7 per cent, or one-third of the customary loss. The same mechanical improvements recommended for small grains hold with soybeans and in addition reduced cylinder speeds and increased separator speeds were found advisable. The correct cylinder speed for soybeans is a problem to be solved. The storage of soybeans requires no attention as the beans come from the harvester in good storing condition.

Surface water supply of the Sacramento River Basin, California, 1895–1927, H. D. McGLASHAN (*U. S. Geol. Survey, Water-Supply Paper 597–E (1929), pp. VI+189–243*).—This report, prepared in cooperation with the State of California, presents a summary of measurements of flow made on streams in the Sacramento River Basin in California during the period 1895–1927.

Surface water supply of Pacific slope basins in California, 1925, (*U. S. Geol. Survey, Water-Supply Paper 611 (1929), pp. VIII+383, fig. 1*).—This report, prepared in cooperation with the States of California and Oregon, presents the results of measurements of flow made on streams in Pacific slope basins in California during the year ended September 30, 1925.

Geology and ground-water resources of central and southern Rosebud County, Montana, B. C. Renick (*U. S. Geol. Survey, Water-Supply Paper 600 (1929), pp. X+140, pls. 11, figs. 15, map 1*).—The area considered in this report is in southeastern Montana and covers about 3,000 square miles of Rosebud County. The chief water-bearing formations in the area are the sandstone and coal beds of the Lance formation and the sandstone, coal, and clinker beds of the Fort Union formation. A supply of water can generally be secured where these two formations are thick enough to extend below the water table. In these two formations and probably also in the underlying formations water from depths less than 125 ft. contains considerable calcium and magnesium, but the water from greater depths is soft, the natural softening being due to the fact that as the water gradually percolates downward and moves laterally, the silicate minerals in the rocks exchange their sodium for the calcium and magnesium in the water. Flowing artesian wells along the flood plain of the Yellowstone River in the eastern part of the area derive their water from the Lance formation, while those along the flood plain of the Tongue River derive their water from the Fort Union formation. The water from all the artesian wells is soft.

Chemical analyses of the waters are reported by H. B. Riffenburg.

Ground water in Yellowstone and Treasure Counties, Montana, G. M. Hall and C. S. Howard (*U. S. Geol. Survey, Water-Supply Paper 599 (1929), pp. VI+118, pls. 7, figs. 5*).—This report, prepared in cooperation with the Montana State College and State Board of Health and the Montana State engineer, deals with the physiography, geology, and underground water supplies of Yellowstone and Treasure Counties, constituting a combined area of 3,571 square miles in south-central Montana. Special attention is devoted to the development of the underground water supplies.

Geology and water resources of the upper McKenzie Valley, Oregon, H. T. Stearns (*U. S. Geol. Survey, Water-Supply Paper 597-D (1929), pp. II+171-188, pls. 3, figs. 2*).—The results of a study of the geology, physiography, and water resources of the upper McKenzie Valley in Oregon are presented. These indicate that two epochs of lava filling with the resulting formation of lakes, waterfalls, subterranean streams, and large springs are the outstanding features in the geologic development of the valley.

From an analysis of the stream-flow records it appears that the flow from springs is equivalent to an intake of 36.63 in. over the entire drainage area, or nearly 60 per cent of the annual run-off, about 50 per cent of the total annual precipitation, and about 75 per cent of the annual precipitation over the intake area of permeable basalt that supplies the springs. It is estimated that the flow from springs in the valley is about 925 sec.-ft., or about 670,000 acre-ft. a year. Of this amount about 520 sec.-ft. rises in four spring groups. All these springs issue from basalt, and three of them discharge about 150 sec.-ft. each. The size of the springs is evidence of the remarkable permeability of the basaltic flows of this region.

Visible leaks on the southeast shore of Clear Lake indicate that this lake is unfit for use as a storage reservoir.

Surface water supply of Pacific slope basins in Washington and upper Columbia River basin, 1925 (*U. S. Geol. Survey, Water-Supply Paper 612 (1929), pp. V+160, fig. 1*).—This report, prepared in cooperation with the States of Washington, Montana, and Idaho, presents the results of measurements of flow made on streams in Pacific slope basins in Washington and in the upper Columbia River basin during the year ended September 30, 1925.

Problems of the soft-water supply of the Dakota sandstone, with special reference to the conditions at Canton, South Dakota, O. E. Meinzer

(*U. S. Geol. Survey, Water-Supply Paper 597–C (1929), pp. II+147–170, pl. 1, figs. 4*).—A description is given of the geology and ground water conditions of the Dakota sandstone and data given from studies of well development, the chemical character of the water, and the physical properties of the water-bearing sandstone.

The Dakota sandstone water is notably different from that in the gravel in its content of mineral matter and hence in its chemical behavior. The gravel water contains large quantities of calcium and magnesium, which make it hard, whereas the sandstone water is low in these constituents and hence relatively soft. The large amount of magnesium and sodium sulfates in the gravel water makes it somewhat objectionable for drinking and cooking. The sandstone water is therefore much better for drinking, for domestic uses, and for use in steam boilers. The gravel water is, however, superior in containing only a negligible amount of iron, whereas the sandstone water contains an appreciable amount of iron, which is objectionable for toilet and laundry uses.

An indication of swimming pool pollution (*Michigan Sta. [Bien.] Rpt. 1927–28, p. 9*).—Since *Bacillus coli* may be found as a result of multiplication in the water rather than as that of a primary pollution, a streptococcus species, "probably of nose and throat origin," is considered a more reliable index. A residual chlorine content of 0.2 part per million, maintained at all times, is recommended as obviating, if the procedure be rigidly maintained, the necessity for bacteriological tests.

Measurement of irrigation water, G. D. Clyde (*Utah Sta. Circ. 77 (1929), pp. 40, figs. 17*).—This is a revision of Circular 36 (E. S. R., 40, p. 785). It presents the elements of water measurement, and includes a statement of the fundamental units used and a discussion of the common methods of water measurement, together with the necessary tables and formulas.

Stoning farm lands, M. J. Thompson and A. J. Schwantes (*Minnesota Sta. Bul. 250 (1929), pp. 28, figs. 12*).—The results of an extensive study of the removal of stones from farm lands are reported. These show that the wagon with a low bed is advantageous for loading and that the dump wagon is easily and quickly unloaded if the stones are not to be piled. Of the vehicles used in transportation tested, the dump wagon was found to be the most efficient, followed in order by the low wagon, farm wagon, and stone boat.

The efficiency of hauling stones was found to be about 25 per cent less on broken land than on sod land. The time required to remove a unit quantity of stone increases as the length of haul increases, but does not increase in proportion to the distance, because the time for loading and unloading remains the same regardless of change in distance. Where stones are numerous, two men will load a wagon in about 13.5 minutes and a stone boat in about 8 minutes. The time for unloading with the different vehicles varies from 1 minute or less to 15 or 20 minutes. The average size of load for each vehicle is as follows: Farm wagon 28 cu. ft., dump wagon 20, low wagon 19, and stone boat 10 cu. ft.

In the blasting tests is was found that mud capping can not be properly done unless the stone is entirely out of the ground. Both the volume of a stone and the diameter perpendicular to the position of the charge are important factors in determining the size of charge necessary for mud capping. Volume, however, has slightly more influence than diameter. The proper size of charge for mud capping granite boulders may be determined by the following formulas: For 40 per cent dynamite, $S=\frac{V}{4}+\frac{D}{16}-\frac{1}{4}$; for 60 per cent dynamite, $S=\frac{V}{4}+\frac{D}{40}$; $S=$ size of charge in sticks, $V=$volume in cubic feet, $D=$diameter perpendicular to position of charge in inches.

Undermining has the advantage of breaking the stone and throwing it out of the ground with one shot. The cost of burying large boulders without breaking them ranges from 3 to 4 cts. per cubic foot of stone. The cost of breaking large boulders and removing the pieces is about 4.25 cts. per cubic foot of stone. Stones may be buried in deep pits at a cost of about $2 per cord and in trenches at a cost ranging from $2 to $4 per cord.

About 65.2 per cent of the total cost of clearing land of stone is man labor, 22.7 per cent is horse labor, and 12.1 per cent is explosive materials. Hauling is the largest item of the cost of stone removal. It constitutes about 75 per cent of the total when the distance is short.

Public Roads, [June and July, 1929] (*U. S. Dept. Agr., Public Roads, 10 (1929), Nos. 4, pp. 65–84+[2], figs. 17; 5, pp. 85–99+[2], figs. 24*).—These numbers of this periodical contain, respectively, the status of Federal-aid highway construction as of May 31 and June 30, 1929, together with the following articles:

No. *4*.—Mechanics of Progressive Cracking in Concrete Pavements, by H. M. Westergaard (pp. 65–71), and Effect of Type and Gradation of Coarse Aggregate upon the Strength of Concrete, by W. F. Kellermann (pp. 72–84).

No. 5.—Effect of Wheel Type on Impact Reaction, by J. A. Buchanan and E. G. Lapham (pp. 85–94, 97); A Test for Indicating the Surface Hardness of Concrete Pavements, by L. W. Teller (pp. 95–97); and General Features of Design of Cross Section of Concrete Pavements on Federal-Aid Projects Submitted in 1928 (pp. 98, 99).

The strength of North American woods, H. S. Betts (*U. S. Dept. Agr., Misc. Pub. 46 (1929), pp. 18*).—The mechanical properties of 129 different woods grown in the United States are presented in tabular form and discussed, these being based on approximately 130,000 tests by the U. S. Forest Service over a period of about 15 years.

The data indicate that the strength of different species of wood varies in general as their specific gravity or their dry weight. Some species, however, have individual characteristics which at times cause wide deviation from this rule. Dry weight is a measure of the strength of individual pieces of any one species. No differences in mechanical properties due to a change from sapwood to heartwood have been found.

Exceedingly rapid or slow growth in conifers, such as the southern pines and Douglas fir, has usually been found to be attended by light weight and inferior mechanical properties. In the case of hardwoods, such as hickory and ash, fast-grown wood with few annual rings to the inch is generally stronger and heavier than wood of slow growth.

The effect of the locality in which trees grow on the nature of the timber produced is very complex. Variations in strength properties of the wood of a certain species attributed to difference in locality of growth are frequently exaggerated. For a single species there is likely to be a greater difference in strength between the wood of trees grown in the same locality than between the average strength of material from different regions.

Trees growing close together and apparently under the same conditions occasionally show a difference in their mechanical properties that can not be entirely accounted for by the difference in density. Whether this difference is due to the ancestry of the tree or to some other cause, such as soil conditions, is not yet known.

The strength of small, clear pieces is greatly increased by seasoning. In large timbers, the increased strength attending a loss of moisture is mostly offset by checks and other defects developed during the seasoning process, and,

therefore, under most conditions it is not considered advisable to anticipate any added strength due to seasoning.

A farm machinery survey of selected districts in Pennsylvania, H. B. Josephson, W. R. Humphries, and L. M. Church (*Pennsylvania Sta. Bul. 237* (*1929*), *pp. 15, figs. 3*).—A summary of data on the use of machinery on Pennsylvania farms is presented, which was prepared by the station in cooperation with the U. S. D. A. Bureau of Public Roads and the Pennsylvania Department of Agriculture.

Among other things it was found that tractors were used 36.6 days per year, 23.9 days for drawbar work, and 12.7 days for belt work. Walking plows were in common use in all sections studied; riding plows were rarely found, with the exception of two-way sulky plows. The one-row riding cultivator, used with two horses, was practically universal throughout the State.

The team of two horses was the most common power unit. Some farmers use four horses for harrowing, loading hay, and cutting grain. In Lancaster County three horses were commonly used for plowing, harrowing, and cutting grain.

The years of service rendered by machines did not vary greatly with the amount of use. The cost per year for using machines is a better index than cost per acre, because of the great difference in the amount of annual use. The cost of using machines, when figured on a per acre basis, is high in many cases beause of small acreage.

[**Agricultural engineering investigations at the North Carolina Station**], D. S. Weaver (*North Carolina Sta. Rpt. 1928, pp. 42–45, figs. 3*).—A comparison of the efficiencies of 1-, 2-, and 4-horse, and tractor-plowing outfits showed the best results were obtained from the 4-horse plowing outfits. The excellent results given by one 4-horse outfit emphasized the benefits of good horsemanship.

An efficiency study of 1- and 2-horse cultivators in cotton production showed that with man labor at 20 cts. per hour and horse labor at 15 cts. per hour, the labor cost per acre cultivated was 40 per cent greater with the 1-horse type. In optimum soil conditions and with a very careful operator during the first cultivation, it was observed that the 1-horse cultivator could cultivate closer to the row with less damage to the crop, but in the hard places in the field the operator could not prevent plowing out and covering more of the crop than did the 2-horse type, with its greater weight and ease of control. Careless operation or even average operation of the 1-horse type indicates the great superiority of the 2-horse cultivator as regards thoroughness in cultivating. One very striking comparison in favor of the 2-horse type which was noted is the fact that in extremely hard ground, penetration could not be secured with the 1-horse implement except with the use of 2-in. shovels, which failed to destroy the grass between the rows. The 2-horse type with its greater weight and accuracy of control in the same hard ground was equipped with sweeps which completely removed the grass.

As regards best cultivation in crossing terraces it was observed that on rows running at right angles to the terrace bank the 2-horse implement could be adjusted by means of the leveling lever to do as thorough work as the 1-horse type, but where a leveling lever was not provided, or, when provided, was not used, the 1-horse implement cultivated the terrace portion more uniformly. In crossing terraces at acute angles, the 1-horse type gave more uniform cultivation.

Farm power and labor, H. B. Josephson and R. U. Blasingame (*Pennsylvania Sta. Bul. 238* (*1929*), *pp. 20, figs. 9*).—The results of two years of pre-

liminary study of the power and labor requirements of Pennsylvania agriculture and how they may be profitably reduced by engineering procedure are summarized in this bulletin.

From a study of a two-plow general-purpose tractor, it was found that the average cost per hour for using the tractor during two seasons, at all kinds of farm work, was 84 cts. The average cost per hour for fuel, oil, and grease was 34 cts., leaving 50 cts. for fixed charges. These figures do not include the operator's time.

When rocks do not interfere appreciably, plowing with the tractor was done with 1.7 man-hours per acre at a total cost of $2.33, while it required 5 man-hours and cost $3.80 per acre to plow similar land with teams and walking plows. To plow moderately stony fields with the tractor took 2.9 man-hours and cost $3.47 per acre, while plowing very stony fields required 3.6 man-hours and cost $4.07 per acre when using the tractor. When using teams and walking plows, rocks did not appreciably affect the time required or the cost of plowing.

The greatest saving in labor and expense through the use of the tractor was in seed bed preparation. In spring-tooth harrowing, for example, 0.27 man-hour per acre was required when using the tractor, 0.43 man-hour when using four horses, and 0.8 man-hour when using two horses. The cost per acre was 39 cts. when using the tractor, 53 cts. with four horses, and 62 cts. with two horses. In drilling grain, cultivating corn and potatoes, mowing hay, and cutting grain, considerable labor was saved through the use of the tractor, but the cost was not appreciably reduced.

No labor was saved in planting corn, spraying potatoes, spreading manure, or digging potatoes with the tractor as compared with using common Pennsylvania practices, and the cost was slightly higher when the tractor was used.

In plowing stony ground with tractors it is important to use a spring-release hitch that may be quickly and easily rehitched from the operator's seat.

The cost of clearing typical limestone land with dynamite was $35 to $53 per acre. This expense is justified only when the potential money value of the crops produced is high.

The combine method of harvesting wheat reduced the labor from 8.5 man-hours per acre to 2.7 man-hours when the straw was left in the field. There was also considerable saving in cost. Considerable labor was saved, even when the straw was removed, but the cost was then higher than for the binder and thresher method. Similar results were obtained with oats. The future of the combine harvester in Pennsylvania depends on the development of a satisfactory method of saving the straw and of suitable equipment for drying the grain.

Picking potatoes behind an elevator digger required nearly one-third of the total man labor in producing the crop. This is entirely a hand operation and there is need for labor-saving machinery in potato harvesting.

The combined harvester-thresher in North Dakota, A. H. Benton et al. (*North Dakota Sta. Bul. 225 (1929), pp. 49, figs. 18*).—The results are presented of a broadly cooperative study by the station and the U. S. D. A. Bureaus of Public Roads and Agricultural Economics. These indicate that the maximum moisture content at which wheat may be safely stored is about 14 per cent. The requirements for rye, oats, and barley are about the same. For flax the moisture content for safe storage is distinctly lower.

The wheat commonly grown in North Dakota is fairly resistant to shattering. Rye and oats shatter more readily than wheat, as does barley. Barley straw is brittle and heads break off easily when dry. Flax does not shatter, but bolls may drop off, due to insect or rust injury. An increase in the relative humidity of the air usually brings about an increase in moisture content of grain.

Immature weed seeds and other fine dockage of high moisture content are frequently present in grain. The excess moisture in such dockage transfers rapidly to otherwise dry grain. Dockage should be removed before the grain is placed in storage.

Wheat combined and stored when dry, unless damaged before threshing, is equally as desirable as wheat harvested with a binder and threshed from the shock. Weathering may affect the weight per bushel of wheat. The flour yield apparently is not affected to the same extent. The protein content does not change, nor does the baking strength of the flour. If the wheat has weathered badly the color may be injured, especially in durum wheat.

Terminal marketing data on 30 cars of combine wheat in 1928 showed slightly over 14 per cent moisture. Similar marketing data on 26 cars of shock-threshed wheat from the same country elevators showed slightly over 13 per cent moisture. A higher moisture content of the combine wheat reduced the grade from No. 1 to No. 2 and lowered the price about 2 cts. a bushel as compared to the shock-threshed grain. Grain commission merchants report that combine grain can not be distinguished from other grain.

Removing foreign materials and dockage, mixing damp grain with dry grain, storing in shallow layers or in ventilated deep bins or drying with heated air are the most common methods that may be helpful in preventing damage to grain in storage.

The germination and milling and baking qualities of wheat were apparently not affected by artificial drying with heated air at a temperature of 160° F. The rate at which grain is dried has no appreciable effect on the maximum weight per bushel. The cost of the fuel required to dry grain artificially was small in comparison with the net increase in market value from drying.

In the combine studies it was found that loss of grain in the head is due to improper cylinder and concave adjustment. The cracking of grain is caused by insufficient clearance between cylinder and concave teeth, excessive speed of cylinder, excessive tailings, or end play in the cylinder. The secret of clean and efficient separation lies in the operator's ability to prevent overloading the sieves.

The average acreages harvested by the different sizes of combines were found to be slightly over 500 acres for the 10- and 12-ft., 717 for the 15-ft., and 1,296 acres for the 20-ft.

The average acreages harvested per day were found to be 25 acres for the 10-ft. combine and 30 acres for the 16-ft. combine. The 12- and 16-ft. windrowers averaged 48 and 55 acres per day, respectively.

The man labor involved in harvesting with the combine is approximately one-fourth the amount required in the binder-thresher method. The combine owner is thus practically independent of transient labor for harvesting.

The costs of direct combining, exclusive of depreciation, interest on the combine and overhead averaged 93 cts. per acre for the 16-ft. and \$1.03 for the 10-ft. The acreage harvested per season materially affects the total cost per acre due to the varying depreciation and interest charges.

On the basis of 600 acres, the total cost of harvesting with a 16-ft. combine averaged \$1.52 per acre when direct combined and about \$2 when the windrow pick-up method was used. When harvesting and threshing this acreage, the total costs averaged \$3.32 per acre with three 8-ft. binders and thresher, and \$3.26 if only two 8-ft. binders were used. On the basis of 500 acres the total cost of direct combining with the 10-ft. machine amounted to \$1.54 per acre.

A grille for threshing soybean selections, R. P. Bledsoe (*Georgia Sta. Circ. 85 (1929), pp. 4, figs. 4*).—A grille for threshing soybean specimens is

briefly described and illustrated. It consists essentially of a boxlike supporting frame and the grille itself. A large electric fan provides an air blast for cleaning the seed.

Essentials of a mulch paper laying machine, H. H. MUSSELMAN (*Michigan Sta. Circ. 126 (1929), pp. 7, figs. 3*).—The essential features of a machine for laying mulch paper are briefly described and illustrated and a bill of materials included.

The Oregon apple-washer, H. HARTMAN (*Oregon Sta. Circ. 92 (1929), pp. 4, figs. 4*).—An apple-washing machine developed by the station is described and illustrated. It is of the flotation type and consists essentially of a two-compartment tank, one compartment for the washing solution and another for the rinse or fresh water bath. The fruit is propelled on the surface of the liquid by paddle wheels and is lifted out by endless-chain elevators.

Feed-lot and ranch equipment for beef cattle, W. H. BLACK and V. V. PARR (*U. S. Dept. Agr., Farmers' Bul. 1584 (1929), pp. II+22, figs. 30*).—Practical equipment which is more or less essential in the successful handling of beef cattle on the range and in the feed lot is discussed in this bulletin and illustrated by drawings and photographs. This includes sheds, windbreaks, self-feeders, feed troughs, hayracks, watering tanks and troughs, feeding floors, silos, scales and scale pens, dehorning and branding chutes, corrals, dipping vats, and cattle guards.

Farm milk houses, F. E. FOGLE and P. S. LUCAS (*Michigan Sta. Circ. 123 (1929), pp. 7, figs. 4*).—General information and working drawings for the construction of farm milk houses and equipment are presented.

The solar heater, A. W. FARRALL (*California Sta. Bul. 469 (1929), pp. 32, figs. 21*).—The results of studies of the solar heating of water are reported and the design of simple solar heaters for this purpose is described. Where there is abundant sunshine, the solar heater seems to offer a practical means of supplying hot water for dairy and household purposes. It should be used in conjunction with a well-insulated water-storage tank, and for continuous service it should have an auxiliary oil, gas, or electric heater. For average conditions in the warm interior valleys of California, 1 sq. ft. of glass-absorber area should be used per gallon of water to be heated per day. The most efficient location for the absorber is on the south slope of an unshaded roof.

The tests show that temperatures of 280° F. are obtainable under the glass of a well-insulated solar heater. Daily averages of as high as 3 B. t. u. per square foot per minute between the hours of 8 a. m. and 5 p. m. are easily obtainable by simple solar heaters. The absorber box should be insulated against heat loss. Good cork insulation is recommended. If high temperatures are desired, it is best to use a double glass cover with air space between. A tight glass should be placed over the absorber box in order to retain the heat and to prevent air currents from cooling off the pipes.

The area of the pipe or absorbing surface in direct contact with the sun's rays should approach the area of the glass as nearly as possible, for maximum absorption. Embedding coils in concrete or other materials having good conduction greatly increases the efficiency of the absorber. This type works fairly satisfactorily in protected places, without the use of a cover glass. The inside of the absorber and the exposed part of the water coils should be painted a dull black.

The absorber should be set at an angle such that it will be most efficient in the early spring months, rather than in the summer; 35° angle to horizontal is suggested for places with the latitude of Davis, Calif. The maximum heat absorption takes place when the plane of the absorber is kept at 90° to the sun's

rays; the most satisfactory practical installation, however, is to build the absorber stationary and of a size sufficient to furnish the required amount of heat under all conditions. Some heat is absorbed by the solar heater even on hazy and cloudy days. Solar heating systems should have a large storage or reserve capacity.

The percentage of solar radiation reaching the earth is largely affected by atmospheric conditions, and also varies from day to day at the source.

A shut-off valve in the discharge line between the absorber and the tank may be advantageous in some installations, where it is desired to stop the back circulation due to cooling of the absorber at night.

Annual report of the department of sewage disposal for the year ending June 30, 1928, W. RUDOLFS (*New Jersey Stas. Bul. 486 (1929), pp. 80, figs. 28; abs. in Rpt. 1928, pp. 305, 306*).—Various studies on the biology of sewage disposal conducted during the year are described and the results summarized.

With reference to the color of sewage sludges it was found by Rudolfs and C. N. Henderson that the common belief that a color of sewage solids indicates good digestion is erroneous. This was borne out by checking a number of sludges from disposal plants from different parts of the country. The ash content of the different sludges is a fairly good indication, however, provided the initial ash content of the material is known.

In studies by P. J. A. Zeller of the effect of freezing on sludge digestion it was found that gas production stopped completely at a low temperature of —2° C., increased gradually above 12°, and resumed its original rate as soon as the mixture had reached 20°. The total gas production per gram of volatile matter was not altered by freezing, regardless of whether the freezing was practiced at the beginning or during the course of digestion. The percentages of volatile matter reduction and ash increase were not affected by prefreezing or freezing at intervals. Prefrozen ripe sludge was as effective for seeding purposes as unfrozen material.

Rudolfs and I. O. Lacy found that dye manufacturing waste containing chlorides, sulfates, iron, and dye retarded the digestion of a mixture of this waste with domestic sewage sludge. A sewage disposal plant receiving this particular type of trade waste would very likely require about 25 per cent larger sludge digestion capacity than a disposal plant not receiving this waste.

In studies by Rudolfs and Zeller of the effect of reaction control on gas production from sludge, samples of unseeded fresh solids were digested at temperatures of 24 and 30° C., with and without the application of lime. The gas collection data showed that with the reaction adjusted to pH 7.6 and at a temperature of 24° (75° F.) the peak of gas production was reached in half the time required by the unlimed sample. The quantity of gas produced per gram of volatile matter was increased 16 per cent by liming and 20 per cent by the higher temperature. The average rate of gas production up to the peak was increased 185 per cent by liming and 68 per cent by higher temperature. The average composition of the gas was practically the same in all cases over a period of 200 days. The fuel value of the gas, in the case of the limed sample, was sufficient to raise the digesting material from 16 to 24° in 12 days.

Studies by H. Heukelekian on the effect of sterilizing fresh solids on the digestion of seeded mixtures showed that the addition of sterile fresh solids to ripe sludge does not retard digestion, but on the contrary seems to have a stimulating effect which may be due to the increased availability of the substances in fresh solids on heating.

In studies by Rudolfs of the decomposition of relatively pure nitrogenous and carbonaceous materials and oils in sewage, great differences were found in

the production of acidity, alkalinity, ammonia, nitrates, and the amounts of gases produced. All substances produced odors.

Heukelekian found that mineral oil is far more resistant to decomposition (if decomposed at all) than cod-liver oil and olive oil. The latter caused a greater stimulation of the bacteria, gave a greater alkalinity, biochemical oxygen demand and volatile matter reduction.

Rudolfs found that the changes in the composition of the gas produced during the course of digestion of fresh solids were considerable. The carbon dioxide content varied from 37.7 per cent during the first week to 25.3 per cent at the end. The methane content varied likewise from 47.8 to 69.8 per cent. From this and other experiments it is deduced that for practical purposes from 80 to 85 per cent of the possible total gas produced is the practical limit.

An experiment by J. T. Pedlow to determine the source, the identity, and the changes taking place in the character of the material suspended in the liquid above digesting sewage sludge showed that during the first stage of decomposition the major portion of the suspended matter is finely subdivided carbonaceous material. The fine state of subdivision is accomplished in the sludge layer during acid digestion, and the material is transferred to the liquid layer by gas bubbles. It remains suspended because its density is practically the same as that of the liquid. The mass of this carbonaceous material is returned to the sludge layer by flocculation, and the rest of the suspended matter is decomposed in the liquid in a manner similar to the decomposition in the sludge layer.

Data from other studies are also briefly discussed.

RURAL ECONOMICS AND SOCIOLOGY

[Investigations in agricultural economics at the New Jersey Stations, 1927–28], A. G. WALLER (*New Jersey Stas. Rpt. 1928, pp. 15–23, 89–96*).—Reports of investigations not previously noted are given as follows:

Cost of production work (pp. 17, 18, 89–96).—Tables are given and briefly discussed showing (1) average cost per acre and per unit of production, yields per acre, prices received, and hours of man labor, horse work, and truck labor per acre, 1927, of 40 potato, 40 sweet corn, 20 late cabbage, 31 market tomato, and 22 can house tomato farms, and for 16 potato growers of the 300-bu. club in central New Jersey; (2) percentages of total expenses going for labor, feed, fertilizers, repairs and depreciation, taxes, and miscellaneous items as shown by farm management surveys in different parts of the State for different types of farming, 1924, 1925, and 1926; (3) summary of farm management survey data for 35 Somerset County dairy farms, 1926, with comparison of averages of all farms and of those of the 10 best and 10 poorest farms; (4) total sales of different vegetable crops and percentage of 100 Passiac, Bergen, and Essex County farms growing each crop, 1926; and (5) summary of farm management survey data, 1926, of 100 Burlington County fruit farms with comparison of averages of all farms and of those of the 10 best and the 10 poorest farms, and the farms in the Riverton and Moorestown areas, and the average sales and average acreage per farm of different fruits and vegetables.

[*Philadelphia apple market*] (pp. 20–23).—A brief preliminary report is given of the study made in September, 1927, in cooperation with the Pennsylvania State College of the marketing of apples in Philadelphia. Data are given as to the sources and the quantities of different varieties of apples received and for the retailers from whom information was obtained as to the size of purchases, containers preferred, premium to pay for graded fruit, margin of profit taken, sources of purchases, most popular size sale, varieties handled

at one time, maximum price at which apples moved freely, seasonal distribution of sales, and percentage of sales in different-sized units.

***An economic study of crops and livestock in the purchase region* of Kentucky,** J. B. Hutson, W. G. Finn, and Z. L. Galloway (*Kentucky Sta. Bul. 289 (1928), pp. 307–433, figs. 21*).—This bulletin presents the results of a study made chiefly by the route method in 1924, 1925, and 1926 in cooperation with the Bureau of Agricultural Economics, U. S. D. A. Farm returns records were obtained from 50, 200, and 50 farms, and detailed records regarding requirements for producing different kinds of crops and livestock from 19, 12, and 14 farms in the respective years. Additional records of requirements for production were obtained as follows: Sweetpotatoes 9, alfalfa 11, cotton 9, wheat 19, peaches 6, sheep 8, dairy cattle 54, and poultry 5.

The results obtained on the farms studied; the outstanding weaknesses in farm practices and cost of improvements; production requirements, production, and prices for crop and livestock enterprises; and the nature of the enterprises and advantages and disadvantages of combining them are described and discussed.

Types of farming in South Dakota, R. H. Rogers and F. F. Elliott (*South Dakota Sta. Bul. 238 (1929), pp. 71, figs. 15*).—This bulletin, prepared in cooperation with the U. S. D. A. Bureau of Agricultural Economics, outlines and describes the 13 type-of-farming areas of the State, discusses the natural and economic factors determining the areas, gives the results of special tabulations of the 1925 U. S. Census to show the typical farming systems followed on farms of different sizes, and shows how the material included and similar data may be used by farmers, teachers, and extension and research agencies.

Economic phases of the Arkansas apple industry, A. P. Brodell and C. O. Brannen (*Arkansas Sta. Bul. 236 (1929), pp. 42, figs. 13*).—The status of the apple industry in Arkansas and the trends in plantings, age and variety of trees, production, carload shipments, and prices in the United States, Arkansas, and near-by States are discussed.

Based on data obtained from shippers and 73 orchardists in Washington and Benton Counties in the summer and fall of 1927, tables are included showing the average acreage of apples, other fruits, and field crops on the farms by size groups; cost by items and by years of developing an acre of apple orchard in northwest Arkansas; usual practice and cost of preharvest operations for bearing orchards; estimated cost per acre, by items, of operating bearing orchards, exclusive of harvesting, packing, and marketing; estimated cost of picking, hauling, and packing different varieties of apples; and yield by varieties of a selected orchard, 1914–1927. Other tables show the average f. o. b. prices, 1924–1926, paid to Arkansas shippers for different varieties of apples; carlot unloads of Arkansas apples, 1922–1927, at selected markets; carload shipments of Arkansas apples, by varieties, 1924–1926; freight rates from different shipping points to different markets; and distribution by varieties of carload supply of apples, July 1, 1926, to June 30, 1927, of the principal southern and central markets.

Cost of handling citrus fruit from the tree to the car in Florida, H. G. Hamilton (*Florida Sta. Bul. 202 (1929), pp. 317–428, figs. 37*).—This bulletin reports the results of an investigation undertaken to analyze the facilities for handling citrus fruit in Florida and to determine the cost and the factors influencing cost. The data were obtained from the books of 99 packing houses for the season 1924–25, and from 83 of the same houses and 12 others in 1925–26. The itemized costs, total and average, per packing house and per box are given and discussed for floor labor; management; office; building; light, water,

power, and house equipment; and field equipment for each year. A table is given showing the cost of handling citrus fruit in the four sections of the State. The factors influencing cost—investment, volume handled per packing house, volume per grower, capacity of packing house, the time the packing house was in use, number of boxes handled per car capacity of packing house, percentage of grapefruit to total fruit, precooling, one-story v. two-story packing houses, floor area of packing houses, arrangement of building and equipment, rented v. owned packing houses, distance fruit was hauled, and year the packing house began operation—are analyzed.

The total handling costs per box for all fruits were 94.6 cts. and $1.037, respectively, in the two years, of which the items were floor labor 11.3 and 13.5 cts., packing labor 6.6 and 7, management 4.1 and 4.9, office 1.9 and 2.6, packing-house building 2.9 and 3.5, land 0.5 and 0.5, light, water, power, and house equipment 5.6 and 6.7, field equipment 2 and 1.9, material 35.8 and 35.2, precooling 1.4 and 2.1, other direct cost 2.2 and 2.3, picking cost 10.2 and 12.9, and hauling 10 and 10.5 cts.

Correlation analysis of the factors influencing cost showed on the average that each 10 cts. increase in investment per box increased the cost per box 3.8 and 2.2 cts., respectively, in the two years; that for firms without precooling systems each 10,000 boxes increase in volume handled per packing house decreased the cost per box 1.1 and 1.8 cts.; that each 1,000 boxes increase in average volume per grower decreased the cost per box 2.8 and 0.6 cts.; that each 10 per cent increase in the percentage of time the packing house without precooling system was in operation at full capacity decreased the cost per box 2.9 and 3.7 cts.; and that each increase in volume per car capacity of 1,000 boxes decreased the cost per box 0.6 and 1.3 cts.

The following conclusions are indicated: Packing houses without precooling plants should not have a total investment exceeding 50 cts. per box with a normal crop. A volume of at least 75,000 boxes is generally necessary for efficient operation. At least 15,000 boxes per season should be handled per car capacity. If the fruit of individual growers is kept separate until packed, at least 400 boxes per grower is necessary for reasonable cost. The best arrangement for a packing house is a one-story building with conveniently arranged equipment and from 0.1 to 0.4 sq. ft. of floor area per box handled.

Appendixes include a copy of the schedule and a discussion of the correlation method used in the study.

The production and marketing of New York market peas, D. Walker (*New York Cornell Sta. Bul. 475 (1929), pp. 137, figs. 40*).—This bulletin is based on detailed enterprise-cost records for 1925 from 63 pea growers in Erie County and 57 in Madison and Chenango Counties; records of 3 cooperative marketing associations, 1 local shipper, and 6 New York City commission firms; carlot receipt records in New York City of the Bureau of Agricultural Economics, U. S. D. A.; and wholesale price records of the *Producers' Price Current*.

The green pea industry of the United States, areas, acreage, production, transportation rates, competition, etc., is discussed.

Tables and charts are included and discussed showing the farming practices in the Madison and Erie areas; the costs by items of growing, harvesting, and marketing green peas; the returns from marketing peas and by-products; the variations in the cost of production; returns per acre, per bushel, and per hour of labor; the effects of variety, weather, and amount of seed used on yields per acre; and the effects on the cost of production of the number of acres of peas per farm, yield per acre, charge for use of land, and proportion of early and late varieties grown.

The section on marketing describes and discusses the costs, problems, and advantages of the different methods of marketing used by growers in the areas studied; the methods, processes, costs, and problems of marketing green peas at a terminal market in New York City; and the wholesale prices of New York green peas in New York City, the seasonal variation in the receipts, the daily variation in the receipts and prices, and the relation of receipts to prices of State peas in 1926 in New York City.

The appendix includes tables and charts with discussion showing the areas of production, total production, and prices of canning-factory peas; trends of seed-pea production, method of selling and price determination, and margins and transportation cost; and the wholesale prices of green peas for table use in New York City.

The average costs per acre and per bushel, respectively, in 1925 for the 120 farms studied were: For growing $56.04 and 51 cts., picking $42.30 and 39 cts., harvesting vines and peas $8.59 and 8 cts., and marketing $78.60 and 72 cts., total $185.53 and $1.70. The gross receipts consisted of $255.47 per acre and $2.34 per bushel from sales and $1.87 per acre and 2 cts. per bushel from miscellaneous receipts, giving a net return of $71.81 per acre and 66 cts. per bushel.

The study showed the following as to factors affecting yield: Usually the late varieties yield more than the early varieties. Correlation of the June rainfall at Buffalo and the yield on an Erie County farm for 12 years showed that each 0.1 in. increase in rainfall increased the yield 4.4 bu. per acre. The growers in the Madison area using the most seed per acre and those in the Erie area using the average amount secured the highest yields.

The study of the factors affecting cost gave the following results: The number of acres grown per farm is a very important factor in profits that can be made. Costs per acre and per bushel are very closely related to the yield per acre. Yields were highest on the farms with highest land charges, but about the same on the farms with the lowest or average land charges. For the Erie area the average net return per acre was $79.90 on the farms having from 25 to 50 per cent of the acreage in early varieties, as compared with $13.41 and $30.15, respectively, for the groups having less or more. In the Madison area the net return in the 25 to 50 per cent group was $78.13, as compared with $43.73 and $108.03, respectively, for the other groups.

Cost of producing silage and kale in the Willamette Valley, H. E. Selby (*Oregon Sta. Bul. 251 (1929), pp. 34, figs. 7*).—The bulletin is based on data for 1925 to 1927, inclusive, collected by the survey method from 76 farms for all 3 years, 72 farms for 2 years, and 59 farms for 1 year. Tables and graphs give information similar to that previously noted for hay in the valley (E. S. R., 61, p. 582).

The average yields per acre and the average costs of production per ton were: For corn silage 5.7 tons and $7.40, vetch silage 7.9 tons and $4.27, and kale 18.1 tons and $3.78. The strictly cash items amounted to 36, 42, and 37 per cent, respectively, of the total costs for the different crops. Corn silage with less than 4 tons per acre cost $12.08 per ton, and with 10 tons or more $5.03 per ton. The average cost of filling silos with corn silage (cost of cutting in the field not included) was $1.71 per ton.

Causes of differences in poultry profits, R. L. Mighell and F. H. Branch (*Massachusetts Sta. Bul. 251 (1929), pp. 73–91, figs. 5*).—This bulletin is based on records from 144 Massachusetts poultry farms for the year ended October 31, 1926, and 134 farms for the year ended October 31, 1927. A statistical analysis is made of the factors affecting labor income.

The labor return per bird varied from —$1 to zero in four flocks in 1926 and in three in 1927, from $7 to $7.99 in two flocks in 1926, and from $11 to $11.99 in two flocks in 1927. The labor return per bird increased from $1 and 69 cts., respectively, in the two years in flocks having an average annual production of 80 eggs per bird to $3.90 and $3.69 in flocks with an average production of 180 eggs. The labor returns per bird for the two years were $2.56 and $2.22, respectively, where the credits other than market eggs were $2, and $4.81 and $5, respectively, where the other returns were $10. The labor return per bird in 1926 increased from $1.67 where the average number of birds during the year was 50 per cent of the initial number to $3.89 where the average number was 110 per cent, and the comparable returns in 1927 were $1.75 and $3.91, respectively. The labor returns in the respective years increased from $2.39 and $1.98 where the average price received for eggs was 40 cts. per dozen to $3.33 and $3.66 where the average price was 65 cts. per dozen. The labor return per bird in 1927 increased from $1.25 in flocks where 10 per cent of the year's egg production was in September to December, inclusive, to $4.04 where 35 per cent of the production was in these months. An increase of one unit was accompanied by increases in labor returns per bird in the two years as follows: Egg production, 85 and 82 cts.; price of eggs, 20 and 37 cts.; index of change in flock size, 54 and 51 cts.; and other credits than market eggs, 80 cts. and $1.01.

A technical appendix discusses the statistical method used and gives the constants obtained.

Financing the western cattleman, C. I. Bray (*Colorado Sta. Bul. 338* (*1928*), *pp. 87, figs. 32*).—This is a description of the development and financing of the western cattle business from the end of the Civil War to date. As methods of improving the present day financing, the author suggests local agencies or local control of loaning agencies, cooperation, extension of the term of loans in the intermediate credit system of the United States from three to five years, and better production methods.

Financial settlements of defaulting irrigation enterprises, W. A. Hutchins (*U. S. Dept. Agr. Circ. 72* (*1929*), *pp. 46*).—This bulletin presents the results of a study of debt settlements of 37 irrigation projects which have defaulted on obligations and of a number of other projects on which settlement plans have not been put into effect. The causes of default, correction of such causes, character of obligations, parties to debt settlements, character of settlements from creditors' and landowners' standpoints, points involved in refinancing plans, and the methods of protecting paying landowners are discussed.

Brief summaries are included of the essential details of 13 typical settlements.

The farm credit situation in southwestern Arkansas, B. M. Gile (*Arkansas Sta. Bul. 237* (*1929*), *pp. 62, figs. 19*).—This bulletin is based on farm records, principally for the year 1927, secured by the survey method from 107 owner operators and 57 tenants (no croppers) in the district between the towns of Hope and Magnolia, Ark.; from information supplied by 16 bankers and 20 credit merchants; and from a study of the recorded mortgages of a Hempstead and a Nevada County township.

The climate, density of population, markets and industries, transportation facilities, types of farming, soils, and crops of the area are described. The amount of short-term, or seasonal, credit used by owners and tenants and of long-term credit used by owners, the purposes for which each is used, sources, interest paid, etc., and the trends in the amount and source of long-term credit are analyzed and discussed. The basis of the amounts of different types of investments, cash incomes, types of security, etc., are discussed, and also the cash resources and financial progress of the farmers.

The perquisites and wages of hired farm hands, J. C. Folsom (*U. S. Dept. Agr., Bur. Agr. Econ., 1929, pp. [1]+28*).—This is a mimeographed preliminary report based on data obtained through questionnaires from noncasual (hired for a crop season or longer) farm hands for 1925 and from casual (hired for only a short period) farm hands for 1926.

Tables are given for noncasual laborers in 1925 showing by States and geographic divisions the average monthly farm values of perquisites by groups, average cash wages and farm values of perquisites, average monthly cash wages and farm values of perquisites by marital status, and average monthly farm values of board and of board, room, and washing; and by geographic divisions the percentage formed by perquisites of total remuneration and the percentage of laborers receiving some of each group or kind of perquisites by marital status.

Other tables show for casual laborers in 1926 the highest, lowest, and average daily cash earnings and farm values of perquisites, percentages paid by principal methods, and average daily values of perquisites for laborers boarded and not boarded; and by geographic divisions the percentage of laborers receiving specific perquisites, average daily value of certain perquisites, total daily value according to type of lodging furnished, and percentages of total remuneration formed by cash wages and each perquisite.

Reports for 2,117 individuals indicated for the country as a whole a total average value of all perquisites of $30.34 per month and of wages $46.44.

Economic aspects of local elevator organization, H. Metzger and H. B. Price (*Minnesota Sta. Bul. 251 (1929), pp. 55, figs. 15*).—This bulletin reports the results of a survey made in the winter of 1925 in cooperation with the Bureau of Agricultural Economics, U. S. D. A., of 49 local farmers' elevators handling from 25,000 to 703,000 bu. of grain per year. The organization and costs of labor and management, building and site, equipment, and other costs are analyzed and the elements affecting costs are discussed.

The costs of handling grain by the different elevators varied from 1 to 12 cts. per bushel, averaging 5 cts. More than 80 per cent of the elevators had costs ranging from 2 to 9 cts. per bushel. Of the average total costs, labor and management comprised 46 per cent, sideline rental and buildings 20, equipment 12, electricity and gasoline 4, interest on grain 5, insurance on grain 3, taxes on grain 1, and miscellaneous costs 9 per cent. Tables and graphs are included showing the relation between volume of business and the various elementary costs noted above and the combined costs per bushel and the costs of handling different volumes of different grains.

The important factors affecting efficient management as shown by the analysis were as follows: Volume of business was the most important factor in costs. Elevator marketing less than 125,000 bu. of grain had substantially higher costs than those marketing larger volumes. Labor and management was the second factor in importance. The amount of labor used is much more important than the rate paid. Elevators marketing less than 100,000 bu. and doing an ordinary sideline business can not afford more than one regular man. Adjustment of the size and cost of equipment to the probable volume of business is important. Consideration should be given to shifts in type of farming under way in planning buildings. Sidelines increase volume of business and efficiency when properly merchandised. Ability of managers to keep records is an asset to the enterprise.

Some factors affecting the marketing of wool in Australia, New Zealand, the Union of South Africa, England, and France J. F. Walker (*U. S. Dept. Agr., Tech. Bul. 124 (1929), pp. 94, figs. 37*).—This bulletin describes and discusses the status of the sheep industry, flock management, and wool mar-

keting practices in Australia, New Zealand, the Union of South Africa, England, and France.

Appendixes include the New Zealand regulations governing the selling of wool; Australian conditions of sale, season 1927–28; and typical forms used in selling wool.

The cold storage of eggs and poultry, T. W. Heitz (*U. S. Dept. Agr. Circ. 73 (1929), pp. 55, figs. 25*).—This circular discusses the extent, growth, and future of the industry; location of warehouses; methods of refrigeration; construction of plants; preparation of shell, frozen, and dried eggs and poultry for storage; shipping and storing; preparation of refrigerator goods for market; wholesomeness and palatability of storage eggs and poultry; investigations in commercial preservation of poultry products; margins derived from storage; etc.

Crops and Markets, [July, 1929] (*U. S. Dept. Agr., Crops and Markets, 6 (1929), No. 7, pp. 233–280, figs. 3*).—The usual tables, graphs, summaries, reports, etc., are included (E. S. R., 61, p. 584), together with special articles on cotton acreage, July 1; pig survey, June 1; hog outlook, July, 1929; farm returns, 1928, with comparisons; income from agricultural production, 1928–29, with comparisons; and perquisites and wages of hired farm hands, noted above.

[Investigations in rural sociology at the Michigan Station, 1926–1928] (*Michigan Sta. [Bien.] Rpt. 1927–28, pp. 26, 27*).—Investigations are reported upon as follows:

Rural participation in organization enterprises.—An intensive study of organization membership in 4 communities in 3 counties of the State showed that 80 per cent of the organizations serving rural people were located in towns or villages, and that the membership of 85 per cent of the organizations was confined to adults.

[Country to city migration of high school graduates].—Data relative to 4,817 high school graduates from 11 schools in 8 counties showed that not an undue proportion of the abler graduates leave the farm. Of 976 farm-boy graduates, 44 per cent lived on farms one or more years after graduating and 23 per cent permanently. For 1,427 farm-girl graduates the percentages were 43 and 26, respectively.

[Use of leisure time by farm, village, and city families].—A study of 600 farm and 250 village families in 3 communities and 1,000 families in 2 cities showed that for the year 1926–27 the average amount of leisure time was about 1,200 hours for married men and about 1,250 hours for married women. Town men and women and farm women spent slightly more than 50 per cent of their leisure time at home, farm and city men somewhat less, and city women slightly less than 50 per cent. Leisure time at home was spent chiefly by all groups in reading and listening to the radio and phonograph. Town and farm people spent the most time listening to the radio, and city people twice as much time as farm people visiting in the evenings and more time attending movies than either farm or town people. Town families spent the most time camping and attending lodges. An average of about 6 per cent of the leisure time was spent in more or less formally organized groups. Those spending 3 to 9 per cent in formal group activities were slightly younger, had more schooling, had lived in the community a few years longer, had more leisure time, and spent more leisure hours at home than those who spent less than 3 per cent of their leisure time in such activities. The data indicate that farmers rarely join economic organizations unless they have been or are affiliated with other community organizations.

Incomes and expenditures of village and town families in Minnesota, C. C. Zimmerman (*Minnesota Sta. Bul. 253 (1929), pp. 47, fig. 1*).—This bulletin

is based upon data obtained by the survey method from 395 families in 11 villages and towns, ranging in population from 742 to 7,086 in 10 counties of Minnesota.

Tables are included and discussed showing (1) by communities the population, number of business units, and number and average size of families; (2) by occupational groups the distribution of families, amount of wealth, distribution of automobiles, amount of higher education of children, circulation of magazines, books, and farm papers, amount of garden space, amount spent per family for medical service, number and cost of births, relation of size of lots to size and physical equipment of houses, number of rooms, bedrooms, and beds, and the types of heating and lighting systems; and (3) by communities and occupational groups the average income and expenditures per family and per adult unit, percentage distribution of sources of income, average expenditures for groups of items per family and adult unit, average investments by items per family, average expenditures per family for miscellaneous living purposes, proportion of families taking local papers, and the average amounts spent for different household expenses.

The study showed that the upper and more successful elements of town and village life differed from the lower and less successful elements in the extreme emphasis placed by the former upon savings, investments, and the provisions made for the future and for old age and in the improvement of the home and housing conditions. In comparing farmers with the successful urban classes as regards distribution of spendable incomes, the author concludes that the major ideals as to what constitutes successful living are essentially the same in both groups.

[Investigations in rural sociology at the Virginia Station, 1919–1927], W. E. GARNETT (*Virginia Sta. Rpt. 1920–1927, pp. 103–111*).—Preliminary reports of investigations not previously noted are reported as follows:

Community development study.—The most significant changes taking place in community life were found to be the tendencies (1) of small neighborhoods to break up, due to improved roads, general use of automobiles, consolidation of schools, transference of trade to larger centers, and free delivery of mail; (2) for town workers to have their homes in the country; and (3) to substitute commercialized recreation for the old types of neighborhood sociability. Recrystallization into larger and more efficient community units has not yet been general. The data gathered indicated that satisfactory progress in the various phases of community life will be possible only with more united support by all groups of systematic long-time plans of development based on all available technical assistance.

[The rural church].—The study showed the following, respectively, for rural and urban churches in Virginia: People available per church, 300 and 750, average membership 118 and 585, and per capita contributions $11 and $21. About 50 per cent of the membership of rural churches was found to be inactive. One of the main troubles with struggling rural churches was found to be that they were slow or bad entirely failed to adjust themselves through consolidation to new methods of transportation. Another difficulty has been the fact that the present leadership for the most part has been trained along conventional lines and has no knowledge or vision of the relation of the church to community welfare.

Young people's religious organizations.—The smallness of the church and the lack of competent, interested leadership were found to be the main causes for rural churches not being successful with such organizations.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Relative costs of extension methods which influence changes in farm and home practices, H. J. BAKER and M. C. WILSON (*U. S. Dept. Agr., Tech. Bul. 125 (1929), pp. 31, figs. 12*).—This bulletin, the third in the series previously noted (E. S. R., 61, p. 188), is based upon cost schedules filled in by 723 county agricultural, 254 home demonstration, and 42 boys' and girls' club agents, and 232 agricultural and 57 home economics specialists in 17 States, which had 43.8 per cent of the extension workers of the United States in the year ended June 30, 1928.

Tables and graphs are given and discussed, showing (1) for the highest and lowest State and the average for the 17 States the percentage of funds spent on various extension methods, the percentage of time devoted to the various methods by all extension workers, by county agricultural agents, home demonstration agents, boys' and girls' club agents, and by subject-matter specialists in different subjects; (2) the percentages of correspondence, telephone calls, and circular letters relating to subject matter and to other extension activities, and the percentage of time of extension clerks devoted to different methods; (3) percentage distribution of travel costs of agents and specialists between the different methods; (4) for 14 States the percentages of money spent on, and changes in practices influenced by, different methods; (5) the practices adopted per unit of cost and cost per practice adopted as the results of different methods; and (6) the comparative cost of influencing the adoption of practices, by different groups of methods.

"Measured in terms of changes in farm and home practices, there is a wide range in effectiveness of teaching means and agencies from a cost standpoint. The cheapest means of influencing the adoption of improved practices is the news service, which yields fifteen times the results per unit of expenditure yielded by extension exhibits. Other methods yielding above average returns per unit of expenditure are circular letters, office calls, general meetings, bulletins, and farm and home visits.

"Considering types of methods, the printed word gives largest returns per unit of cost, followed by meetings other than method demonstration and leader training, and by personal-service methods. The cost of influencing adoption of practices by means of objective methods like method-and-result demonstrations, leader-training meetings, and exhibits is approximately twice that of the printed word, meetings, or personal service methods."

Copies of the forms used in collecting the data are included in the appendix.

Home demonstration work under the Smith-Lever Act, 1914–1924, F. E. WARD (*U. S. Dept. Agr. Circ. 43 (1929), pp. 36, figs. 14*).—The work from 1914 to 1924 is discussed by projects. A brief description is included of the development of the work prior to the passage of the Smith-Lever Act in 1914.

FOODS—HUMAN NUTRITION

Selection and use of pork cuts, A. M. CHILD (*Minnesota Sta. Bul. 254 (1929), pp. 26, figs. 12*).—The greater part of this publication is devoted to practical suggestions for cooking pork products. Many of these are based upon experimental studies dealing chiefly with cooking losses expressed as evaporation and dripping in roasted products and broth and fat losses in products cooked in water. These studies are summarized, with experimental data, in an appendix.

Preservation of Hawaiian fruits, J. C. Ripperton and C. Richter (*Hawaii Sta. Rpt. 1928, p. 22*).—It is noted that guava juice canned in large containers for use in jelly making out of season retains its flavor and color, but shows a deterioration in pectin to such an extent as to necessitate the addition of pectin in making jelly from the juice. The storing of the extracted juice is recommended, however, as the cost of the pectin is nominal as compared with the value of the finished product.

The biological value of yeast proteins for the rat, E. U. Still and F. C. Koch (*Amer. Jour. Physiol., 87 (1928), No. 1, pp. 225–248, figs. 6*).—An extensive investigation of the value of Fleishmann's starch-free yeast administered in several different forms is reported, with the conclusion that yeast is not so satisfactory a source of protein in the diet of the rat as is casein and not so satisfactory a source of phosphorus as are casein and neutral inorganic phosphate mixtures. From the standpoint of calcium retention, diets containing yeast to the extent of from 50 to 100 per cent of the total nitrogen are thought to be less favorable than diets containing similar amounts of casein nitrogen.

"The administration of yeast in the quantities usually recommended for therapeutic purposes is not contraindicated because the quantity of yeast protein so consumed is small as compared with the total protein consumption."

The milk feeding of children, E. B. Sterling (*Public Health Rpts. [U. S.], 44 (1929), No. 16, pp. 957–964*).—This report, prepared for the Office International d'Hygiène Publique, consists chiefly of an account of the public health measures taken in some localities, particularly in Minneapolis, Minn., and several counties in New York State, to demonstrate the advantages in breast feeding over artificial feeding as shown by lower infant mortality rates. In addition, the literature is reviewed on the establishment of wet nurses' bureaus and on the use of dried milk, lactic acid milk, and goat's milk in infant feeding.

A list of 15 references to the literature is appended.

The iron content of the albino rat at different stages of the life cycle, C. V. Smythe and R. C. Miller (*Jour. Nutrition, 1 (1929), No. 3, pp. 209–216, fig. 1*).—Data are given on the iron content of rats at birth and at the ages of 9, 20, 40, 60, and 100 days, and of adult rats, including females at the time of parturition, weaning the young, and 30 days after weaning. The stock from which most of the rats had come had been kept for several generations on a commercial calf meal, supplemented by cod-liver oil and wheat germ middlings. The mixture contained 22 per cent of crude protein and 0.027 per cent of iron.

The average iron content of 18 rats at birth was 0.279 mg., or 0.0055 per cent of the body weight. A decrease to 0.0026 per cent occurred during the suckling period, followed by a pronounced increase between the ages of 20 and 40 days to 0.0045 per cent, after which only slight variations took place. The average iron content of six adult rats was 0.0051 per cent of the body weight. The curve of absolute iron content corresponded quite closely to that of body weight, showing that even during the period of marked decrease in percentage of iron there was an absolute appreciable storage. These figures are thought to contradict the general impression that the animal has a reserve store of iron at birth, but rather to indicate that it is born with a percentage content about the same as that of the adult and during the suckling period reaches a condition designated as "normal physiological milk anemia."

Analyses of a number of female rats at the time of parturition showed considerable depletion of iron, but the analysis of a single individual after weaning indicated that the iron content returns to normal during lactation.

A study of the utilization of the iron of meats as compared with other protein foods, R. C. MILLER, E. B. FORBES, and C. V. SMYTHE (*Jour. Nutrition, 1 (1929), No. 3, pp. 217–232, figs. 3*).—This is a progress report of an investigation of the comparative utilization of the iron of meat and other protein foods by albino rats as determined by the iron content of the entire bodies, minus the alimentary tracts, of the experimental animals at the end of the feeding period, usually five weeks. The iron in this study and the one noted above was determined by the colorimetric thiocyanate method as described by Marriott and Wolf (E. S. R., 18, p. 523).

Three series of experiments are reported: The first, on the effects of skim milk powder and whole milk powder; the second, of muscle, kidney, brain, liver, kidney beans, hen's egg, and peanuts, each fed in amounts supplying 16 per cent of crude protein and accompanying iron; and the third, the same materials as in the second, with the exception that the iron contents of the diets were equalized by the addition of a sufficient quantity of the ash of the protein food to bring the iron content of the diet as a whole to 0.0074 per cent. The meats were ground and dried, the eggs beaten and dried, the beans cooked slowly in water until tender and dried without the cooking water, and the peanuts roasted but not salted.

In addition to the protein materials the diets, with the exception of the skim milk diet, contained Crisco, sucrose, and 1 per cent each of NaCl and $CaCo_3$. The skim milk diet was supplemented with starch, Crisco, agar, dried yeast, cod-liver oil, 1 per cent of NaCl, and 0.05 per cent of a mixture of inorganic salts as recommended by Daniels and Hutton (E. S. R., 53, p. 564.)

The rats from stock on the diet noted in the previous paper were placed on the experimental diets at from 24 to 28 days of age when weighing from 40 to 50 gm. The skim milk diet was fed ad libitum and the others in amounts per gram of body weight corresponding to that eaten voluntarily of the least palatable diet. In general the feeding was continued for five weeks, the animals then being killed by chloroform.

Growth was excellent on the diets in which the protein was furnished by milk or eggs, fair on muscle, liver, and kidney, and poor on brains, beans, and peanuts. The iron content of the rats fed for five weeks on skim milk or whole milk powder was approximately 50 per cent of the normal for the age as determined in the previous study.

In the second series the iron content in percentage of body weight was practically normal on all the diets except those in which the protein was furnished by eggs and peanuts, when it was comparatively low. There were more variations in the absolute iron content, that on the egg diet being nearly as high as for beef muscle, kidney, and liver, and higher than for brain. The iron content of the peanut-fed rats was low in absolute as well as relative amounts. The addition of supplementary iron in the form of the ash of the materials was without effect.

In commenting upon these results, the authors state: "There is ground for question as to the validity of the apparent specific effects of the protein foods studied, especially of egg and peanuts, by reason of the facts that the gains in body weight in the several experimental lots were very different, and that determinations were not made of the moisture and fat contents of the bodies of the rats. The existence of milk anemia, however, is certainly well established."

The manganese-copper-iron complex as a factor in hemoglobin building, R. W. TITUS, H. W. CAVE, and J. S. HUGHES (*Jour. Biol. Chem., 80 (1928), No. [illegible] pp. 565–570*).—The previously noted observations (E. S. R., 61, p. 90) on the value of manganese as a supplement to iron for hemoglobin regeneration ha

been extended to rats with similar favorable results. The data reported in the present paper include values for hemoglobin regeneration in grams per 100 cc. of blood over periods of several weeks for rats on diets of liquid whole milk supplemented by 0.5 mg. daily of iron alone and combined with 0.05 mg. of copper, 0.1 mg. of manganese, and the combination of the two. The manganese was in the form of the chloride, prepared by treating manganous carbonate with a minimum amount of hydrochloric acid and treating the solution with hydrogen sulfide under pressure for 12 hours to remove possible traces of copper.

Rats having a fairly high initial hemoglobin content were able to utilize the iron to some extent when unsupplemented by copper or manganese, but those with low hemoglobin showed no beneficial effects of the iron alone. All of the rats receiving the copper supplement and most, but not all, of those receiving manganese grew well and showed satisfactory hemoglobin regeneration. Those receiving both copper and manganese showed the most rapid response of any of the groups. This is thought to indicate the existence of a group of substances rather than a single substance which is active in hemoglobin building.

Blood formation of the albino rat on a standard dietary régime, B. Sure, M. C. Kik, and D. J. Walker (*Jour. Nutrition, 1 (1929), No. 4, pp. 299–310, figs. 3*).—Data are reported on the effect of age and sex upon the hemoglobin and erythrocyte counts of stock rats from the first to the three-hundred-and-fortieth day of life, of age and sex upon the leucocyte count beginning with the seventy-fifth day, and of fertility and lactation upon the hematopoietic function. The stock diet consisted of whole wheat 27 per cent, rolled oats 26, yellow corn 25, oil meal 15, commercial casein 5, cod-liver oil 1, sodium chloride 0.5, calcium carbonate 0.5 per cent, and a liberal supply of fresh whole milk daily. The technic employed was essentially that of Hart et al. (E. S. R., 54, p. 293).

The data show in general that age plays the determining, and sex an insignificant, rôle in the concentration of hemoglobin and erythrocytes. During the nursing period there was a gradual rise in the erythrocyte count. The hemoglobin increased slightly during the first three days, fell rapidly during the subsequent 12 days, remained at about the same level until weaning, and then rose rapidly during the succeeding 5 days. The curve of hemoglobin following weaning showed two marked peaks at the seventy-fifth and two-hundred-and-eightieth days, the lowest point between these two being at about the one-hundred-and-eightieth day. The highest peak in the erythrocyte curve corresponded quite closely with the first peak in hemoglobin, but the subsequent value did not show as much variation. Wide variations in the leucocyte counts in individual animals made it impossible to draw definite conclusions concerning the influence of age and sex.

Pregnancy in the females on the stock diet produced an anemia which was especially marked on the day of delivery of the young and disappeared as lactation progressed. The concentration of hemoglobin and red corpuscles in the lactating rat was greatest near the weaning period.

Influence of the maternal diet on concentration of hemoglobin of nursing young of albino rat, B. Sure and M. C. Kik (*Soc. Expt. Biol. and Med. Proc., 26 (1929), No. 7, pp. 603–605, fig. 1*).—The authors report that considerably high values have been obtained for the hemoglobin concentration and somewhat higher for the erythrocyte count in the blood of nursing rats on a new stock diet than on the one noted above.

The new diet, designated as ration 1145, consists of casein (purified), 20; dehydrated baker's yeast (Northwestern), 10; McCollum's salt mixture No. 185, 4; butterfat, 5; and dextrin, 61 per cent. Marked variations in the

growth of the nursing young have been noted on this diet. Some have shown a greater rate of growth during the first half of the lactation period and inferior growth during the latter part.

Studies on phosphorus and calcium metabolism, P. SCHULTZER (*Acta Med. Scand., Sup. 26 (1928), pp. 560–565*).—A summary is given of metabolism studies conducted with rats on the McCollum rachitic diet 3143, altered in successive experiments by changing the proportions of calcium and phosphorus. The reduction of the calcium below the amount furnished by the original rachitic diet brought about a greater retention of phosphorus and calcium, due to increased resorption. An increase in the phosphorus also increased the retention of both phosphorus and calcium, but in this case through diminished excretion in the urine.

The vitamin A, B, and D content of canned vegetables (*Michigan Sta. [Bien.] Rpt. 1927–28, p. 21*).—A standard variety of peas (Rice No. 13) grown in the college vegetable garden during the summers of 1926 and 1927 was used in this investigation of the effects of various steps in the commercial canning process upon the content of vitamins A, B, and D. The canning was all done at a nearby canning factory.

In the vitamin A studies it was found that storage in a refrigerator had a marked destructive action upon the vitamin A in raw peas; that blanching 5 minutes or less had only a small destructive effect while blanching 10 minutes more than doubled the effect; and that processing 40 minutes destroyed a small amount and 80 minutes more than doubled this amount.

Canning by the usual method of blanching 5 minutes and processing 40 brought about a 45 per cent destruction in the vitamin B content. Most of the destruction appeared to be due to the blanching process, for by decreasing the time to 2 minutes there was only slight destruction of the vitamin.

Both raw and canned peas contained no demonstrable amounts of vitamin D.

The vitamin A action of lipochromes [trans. title], B. and H. VON EULER, and H. HELLSTRÖM (*Biochem. Ztschr., 203 (1928), No. 1–6, pp. 370–384, figs. 9*).—Reviewing the literature on vitamin A and its differentiation from vitamin D and on previous attempts to identify vitamin A with lipochrome pigments, the authors suggest that the failure of Drummond et al. (E. S. R., 55, p. 711) and of Stephenson (E. S. R., 45, p. 563) to obtain evidence of vitamin A activity with carefully purified carotin might have been due to the absence of vitamin D from the experimental diet. With this factor supplied positive results have been obtained in growth experiments with carefully purified carotin from carrots as the sole source of vitamin A in doses of 0.005 mg. per rat per day. Pure carotin and pure lycopin (from tomatoes) were found to give the antimony trichloride reaction for vitamin A, and the absorption spectra of antimony trichloride solutions of carotin and cod-liver oil showed marked similarity. The characteristic carotin spectrum was also given by the oily material from bone marrow and from blood serum, and the antimony trichloride reaction also by blood serum. It is suggested that vitamin A plays a rôle in blood through its oxidation-reduction action.

A note on carotin and vitamin A, T. MOORE (*Lancet [London], 1929, I, No. 10, pp. 499, 500*).—Preliminary experiments upon two samples of carotin have confirmed the conclusions of Von Euler et al., noted above, as to their activity as a source of vitamin A, both preparations sustaining growth in rats in doses of 0.01 mg. daily.

In attempting to interpret this activity in the light of available chemical knowledge of vitamin A, attention is called to the vitamin A concentrate, biosterin. This preparation was stated by Takahashi et al. (E. S. R., 55, p. 593), confirmed by Morton and Heilbron (E. S. R., 60, p. 689), to be characterized by

marked selective adsorption at 320$\mu\mu$, but by no adsorption in the visible spectrum. Carotin, on the other hand, exhibits selective adsorption in the visible spectrum and no marked bands in the ultra-violet region. The minimum physiological dose for rats of each of these materials is said to be the same, 0.005 mg.

In endeavoring to reconcile these difficulties two possibilities are advanced and discussed: "(1) Both carotin and the classical 'vitamin A' may independently possess the same physiological action, or (2) physiological action may be due to an active impurity present in each in amounts so minute as not to affect the physical properties of the materials in bulk."

Carotin and vitamin A (*Jour. Amer. Med. Assoc., 92 (1929), No. 22, pp. 1867, 1868*).—An editorial discussion of the papers noted above.

On the physiological action of carotin, K. KAWAKAMI and R. KIMM (*Imp. Acad. [Japan], Proc., 5 (1929), No. 5, pp. 213–215, figs. 3*).—Carotin purified by repeated crystallization from carbon disulfide and ethyl alcohol was found to be effective in the cure of xerophthalmia in rats on a diet complete except for vitamin A in doses of between 0.03 and 0.05 mg. daily. These results confirm those of Euler et al., noted above, as to the presence of vitamin A in carotin.

The influence of vitamin A deficiency on the oestrous cycle of the rat, K. H. COWARD, (*Jour. Physiol., 67 (1929), No. 1, pp. 26–32, figs. 4*).—Attempts to apply the oestrous cycle test for vitamin A deficiency, as described by Evans and Bishop (E. S. R., 48, p. 864) and confirmed by Macy et al. (E. S. R., 57, p. 390), both to young rats whose stores of vitamin A were depleted early in life and to mature rats with a deficient store of vitamin A are reported, with the conclusion that it is impossible to use the contents of the vagina as a criterion in the diagnosis of vitamin A deficiency on account of observed irregularities in the time of opening of the vagina on a vitamin A-free diet and in the nature of the contents, which may consist of leucocytes only or of cornified cells only. Mature unmated rats on a vitamin A-free diet were found to have normal cycles for some time, after which the smears sometimes consisted only of leucocytes and later only of cornified cells.

Studies on the hydrogen ion concentration in the different regions of the intestinal canal in animals on a normal diet and on a diet containing no vitamin B, N. SCHOUBYE (*Acta Med. Scand., Sup. 26 (1928), pp. 537–546, figs. 4*).—With the use of the quinhydrone electrode, determinations were made of the H-ion concentration of the intestinal contents of four groups of piebald rats; one on a stock diet of oats, corn, milk, and rye bread; one on a synthetic diet of casein, butterfat, starch, agar, yeast, and salt mixture; and two on the same synthetic diet deprived of vitamin B by replacing the yeast with starch. One of these groups showed the usual symptoms of vitamin B deficiency, and the other was made up of rats showing the phenomenon of refection as described by Fridericia et al. (E. S. R., 58, p. 792). The H-ion concentration of the synthetic food mixture containing yeast was 5.35 and of that without 5.55.

The reaction in the stomachs of the rats in all groups was markedly acid, pH 2 to 3. In the intestines there was a gradual increase in pH, especially in the last portion of the ileum. In the first portion of the jejunum the acidity increased for a short distance and then decreased to alkalinity in the remaining portion of the intestines. In normal and refected rats the highest pH values, 7 to 8, were found in the ileum, while in rats showing symptoms of B deficiency the highest alkalinity was in the cecum.

The author suggests that the optimum H-ion concentration in the intestines may vary in different places in accordance with the different stages in the breaking down of foodstuffs, and that an examination of the intermediary

portions of the digestive tract may contribute to a clearer understanding of catabolic and anabolic processes.

The treament of rickets with irradiated ergosterol, E. T. Wilkes, D. W. Follett, and E. Marples (*Amer. Jour. Diseases Children, 37 (1929), No. 3, pp. 483–496, figs. 8*).—Favorable results are reported from the department of pediatrics, Cornell University Medical College and the New York Nursery and Child's Hospital, in the treatment of 22 rachitic infants, varying in age from 9 weeks to 2 years, with a commercial preparation of irradiated ergosterol containing 10 mg. in 1 cc. of sesame oil. Four drops of the preparation were given twice a day, the exact amounts administered varying from 3.2 to 3.6 mg. per day. The preparation was taken well and tolerated. Two of the patients had severe broncho-pneumonia, and several had previously refused or vomited cod-liver oil.

An average time of about 3 weeks was required for the return to normal of the phosphorus and calcium concentration of the serum and X-ray signs of healing, and about 6 weeks for complete healing. Two cases of tetany were healed with irradiated ergosterol, but it is emphasized that caution is necessary in the use of this for tetany in patients showing a high blood phosphorus content.

A similar use of irradiated ergosterol as a prevention of rickets, begun at 2 weeks of age, was successful in the small series of 8 cases studied, with the exception that one premature infant developed slight craniotabes at 3 months of age. This, however, disappeared within 4 weeks, although the dosage was not changed.

The value of different types of glass for transmitting ultraviolet light, E. T. Wyman, A. D. Holmes, L. W. Smith, D. C. Stockbarger, and M. G. Pigott (*Amer. Jour. Diseases Children, 37 (1929), No. 3, pp. 473–482, figs. 9*).—Five groups of rats were placed when 32 days of age on the Steenbock rachitic diet. One group received no treatment and the others were irradiated at a distance of 3 ft. for 15 minutes daily with a Cooper-Hewitt Uviarc lamp, the special cages in which the animals were placed by groups for the irradiation being covered with window glass, Corex glass, Vitaglass, and a screen permitting the passage of all ultra-violet rays. The test was continued for 5 weeks with frequent measurements of weight. At the end of the time determinations were made of the calcium and phosphorus content of the blood and the ash content of the femurs and tibias, and Röntgenograms were made of the right hind legs.

All of the comparisons were consistent in indicating that as much ultra-violet light passed through the Corex glass as was obtained by direct irradiation. The Vitaglass permitted the passage of only a fraction of the effective rays, and the ordinary window glass was useless. Measurements of the transparency of the different types of glass showed that the Corex glass transmitted rays down to 265 $\mu\mu$, the Vitaglass to 290, and two samples of window glass to 312 and 333 $\mu\mu$.

The effect of general irradiation with ultra-violet light upon the frequency of colds, G. H. Maughan and D. F. Smiley (*Jour. Prev. Med., 2 (1928), No. 1, pp. 69–77*).—In an attempt at Cornell University to determine whether systematic irradiation with ultra-violet light during the winter months will reduce the frequency of colds among susceptible persons, a group of 23 students from 18 to 24 years of age received weekly ultra-violet radiations from November 3, 1926, to January 28, 1927. An Alpine sun lamp, 30 in. above the table on which the treatments were given, was used for the irradiations, the exposures being gradually increased to a maximum of 5 minutes for each side of the body. For comparison a group of 58 students of like susceptibility recorded

the number of colds during the same period. In terms of number per person the irradiated group averaged 1.48 and the nonirradiated 2.48 colds, thus giving an apparent reduction as a result of the ultra-violet treatment of 40.3 per cent.

A second group of 11 students irradiated for a somewhat longer period reported not only the number of colds during the period of irradiation but the number remembered for corresponding periods during the previous year. These numbers gave an apparent percentage reduction of 57. A group of 11 men and women, members of the staff of the Cornell University Medical College at Ithaca, reported a reduction from the preceding year of 76.9 per cent in the number of colds as the result of irradiation. In a group of 13 children similarly irradiated the reduction of colds was apparently 51.2 per cent. Since the acute respiratory infections during the year in which these observations were made averaged 33.8 per cent lighter than the preceding year, the percentage reductions in colds reported were corrected for this factor, making the average reduction in frequeucy of colds legitimately chargeable to irradiation 27.9 per cent for these three groups.

Irradiation from a quartz-mercury-vapor lamp as a factor in the control of common colds, G. H. Maughan and D. F. Smiley (*Amer. Jour. Hyg., 9 (1929), No. 2, pp. 466–472*).—In view of the discrepancy between the findings noted above and those reported by Barenberg and coworkers (E. S. R., 58, p. 896), the authors have repeated their comparison of the incidence of colds among nonirradiated and irradiated subjects, all supposedly susceptible to colds.

In the first trial 23 Cornell freshmen were irradiated weekly for a period of 12 weeks ended January 25, 1928, and a group of 26 served as controls. A total of 23 mild and 13 severe colds was reported for the irradiated group, and 44 mild and 29 severe colds for the nonirradiated group. In a second series of 21 irradiated and 24 nonirradiated subjects during the period of 9 weeks ended March 29, the corresponding figures were mild 14 and severe 12 for the irradiated, and mild 42 and severe 25 for the nonirradiated gronp. These figures indicate an apparent reduction in the number of colds of 44.2 per cent in the first series and 55.5 per cent in the second series as a result of the mild irradiation.

The results were thought to justify the use of short weekly irradiations with ultra-violet light in certain cases of marked susceptibility to colds.

Diabetic children, E. P. Joslin and P. White (*Jour. Amer. Med. Assoc., 92 (1929), No. 2, pp. 143–146*).—This is a general discussion of the condition of the diabetic children now in the author's practice. In the 22 months ended July 1, 1928, there were 303 patients listed, six of whom have died. It is stated that the neglect to follow treatment and to keep in constant touch with the family physician was responsible for at least four of these deaths.

The hereditary nature of diabetes is emphasized. Since the disease may be latent in the parent when it has appeared in the child, it is urged that avoidance of obesity be practiced by the relatives of a diabetic child as middle age approaches.

The present status of diabetic children is considered good, although few in whom the disease is of long duration are sugar-free throughout the entire 24 hours. It is said to be the exception for diabetic children of the present time to be underweight or height, and that such tendencies indicate other trouble which should be investigated. Diabetic children now mature sexually and resist all types of infection with proper adjustment of diet and insulin.

MISCELLANEOUS

Report of the Hawaii Agricultural Experiment Station, 1928, J. M. Westgate et al. (*Hawaii Sta. Rpt. 1928, pp. [2]+29, figs. 12*).—This contains

he organization list, a summary by the director as to the work of the year, and reports of the divisions of horticulture, agronomy, and chemistry, the extension and demonstration work on the Island of Hawaii, boys' and girls' club work, and the Haleakala Substation and Demonstration Farm. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Report [of] Michigan Agricultural Experiment Station for the two years ending June 30, 1928, V. R. GARDNER (*Michigan Sta. [Bien.] Rpt. 1927–28, pp. 36*).—This report by the director for the biennium ended June 30, 1928, includes a financial statement for the period and brief notes on the progress of the station. The experimental work reported not previously noted is for the most part abstracted elsewhere in this issue.

Biennial Report of the Missouri State Fruit Experiment Station, Mountain Grove, Mo., 1927–1928, F. W. FAUROT (*Missouri Fruit Sta. Bien. Rpt. 1927–28, pp. 8*).—This contains a financial statement for the fiscal biennium ended December 31, 1928, and a report of the director discussing the needs of the station during the ensuing biennium.

Work of the Huntley Field Station, Montana, in 1925 and 1926, D. HANSEN ET AL. (*U. S. Dept. Agr. Circ. 70 (1929), pp. 36, figs. 5*).—The experimental work reported, carried on at Huntley, Mont., is for the most part abstracted elsewhere in this issue. Meteorological observations at the station, 1911–1926, are included in summary form.

Forty-ninth Annual Report of the New Jersey State Agricultural Experiment Station and the Forty-first Annual Report of the New Jersey Agricultural College Experiment Station for the year ending June 30, 1928, J. G. LIPMAN ET AL. (*New Jersey Stas. Rpt. 1928, pp. XXIX+336, pls. 9, figs. 8*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1928, a report of the director on the work and publications of the year, and departmental reports, the experimental features of which not previously reported are for the most part abstracted elsewhere in this issue.

Fifty-first Annual Report of the North Carolina Agricultural Experiment Station, [1928], R. Y. WINTERS ET AL. (*North Carolina Sta. Rpt. 1928, pp. 94, figs. 16*).—This contains the organization list, a report of the director and heads of departments, and a financial statement for the fiscal year ended June 30, 1928. The experimental work not previously reported is for the most part abstracted elsewhere in this issue.

Edgeley Substation Report for years 1922 to 1928, O. A. THOMPSON (*North Dakota Sta. Bul. 226 (1929), pp. 18, figs. 6*).—The experimental work reported is for the most part abstracted elsewhere in this issue.

Williston Substation Report, April 1, 1928, to March 31, 1929, E. G. SCHOLLANDER (*North Dakota Sta. Bul. 227 (1929), pp. 36, figs. 16*).—The experimental work recorded is for the most part abstracted elsewhere in this issue. Meteorological data for 1928 are also included.

Annual report of the Virginia Agricultural Experiment Station, [1920–1927], A. W. DRINKARD, JR., ET AL. (*Virginia Sta. Rpt. 1920–1927, pp. 168*).—This contains the organization list, a report of the director on the work of the station, departmental reports, two special articles, meteorological data noted on page 718, and financial statements for the fiscal years ended June 30, 1920, to 1927. The experimental work reported not previously noted is for the most part abstracted elsewhere in this issue.

Annual summary of publications, B. C. PITTMAN (*Utah Sta. Circ. 78 (1929), pp. 8*).—This contains a summary of publications issued by the station since July 1, 1928, including abstracts of scientific and technical papers published outside the station series.

NOTES

Arizona Station.—Because of inability to acquire sufficient range the goat breeding experiment at the Prescott Dry-Farm has been temporarily transferred to Tuscon. It is expected that a larger area will be secured on which the experiment will be continued. Carl W. Clark has resigned as foreman at Prescott.

Appointments have been recently made of Mabel L. Lynott as research assistant in nutrition; W. T. McGeorge, associate chemist of the Hawaiian Sugar Planters' Association, as research chemist in soils; and Marion R. Isaacson as assistant chemist.

Arkansas University and Station.—The College of Agriculture has expanded its department of horticulture into a department of horticulture and forestry, with J. R. Cooper as head. Robert P. Holdsworth has been appointed professor of forestry and Charles A. Gillett extension forester vice W. K. Williams, jr., resigned.

Dr. Robert R. Dinwiddie, associated with the veterinary work of the station from its establishment in 1887 to his retirement in 1914, died in August at the age of 72 years. He was a graduate of the Ontario Veterinary College in 1886 and of the St. Louis College of Physicians and Surgeons in 1896. As veterinarian and bacteriologist of the station he was an early worker on Texas fever, hog cholera, and other diseases, and made important contributions to the knowledge regarding them. From 1907 to 1909 he was also professor of animal husbandry and pathology in the College of Agriculture and for some time thereafter consulting pathologist and bacteriologist.

Connecticut State Station.—Supplementing contributions from peach growers of $2,100, the State Board of Finance has made an emergency addition of $5,000 to the insect pest appropriation of the station to rear parasites of the oriental peach moth, which has caused severe damage in Connecticut. *Macrocentrus ancylivora* and *Trichogramma minutum* will be bred during the winter at the station and released in the spring in infested orchards.

A lysimeter to study the leaching of nitrogen from four types of Connecticut soil and other soil problems has been installed at the Tobacco Substation at Windsor at a cost of $3,000. The apparatus, similar to that at the Tennessee Station, includes 102 tanks, some 9 in. deep for use in the analysis of surface leaching and others 20 in. deep to show the percolation through the soil.

Henry Bull (M. F. Yale, 1929) has been appointed research assistant in forestry.

Delaware Station.—Dr. H. L. Dozier resigned as entomologist October 28 to accept a position as chief entomologist with the Department of Agriculture of Haiti and was succeeded on November 1 by Dr. L. A. Stearns, assistant entomologist of the Ohio Station.

Nevada Station.—Cruz Venstrom has been appointed assistant in farm development vice R. M. Clawson, who has accepted a position with the U. S. D. A. Bureau of Agricultural Economics.

New Hampshire University.—Charles James Hall, the new chemistry building, was dedicated November 9. The building is named in honor of a former head of the university department of chemistry, and the exercises included tributes to him as teacher by Dr. Lester A. Pratt and as chemist by Dr. Irving C. Langmuir. Other speakers included Dr. Charles L. Parsons, formerly of the institution, on The Laboratory—the Key to Progress, and Dr. H. G. Knight, chief of the U. S. D. A. Bureau of Chemistry and Soils. Dr. Knight's address was entitled Relation of Chemistry to Agriculture and Biology. Some of the opportunities open to chemists were pointed out along such lines as the control of insects through the development of chemical insecticides and similar products, the possibility of greater utilization of the by-products and wastes of the farm, the improvement of processes for tanning hides and skins, and increasing the yield and protein content of the hay crop.

Pennsylvania College.—The school of forestry has been merged by legislative action with the Mont Alto Forestry School as the Pennsylvania State Forest School under the direction of the college. Under the plan of instruction adopted, the freshman year and the first year of the ranger course will be given at Mont Alto, where a dormitory accommodating about 80 students and a forest school building erected in 1928 are available, together with the extensive facilities of the Mont Alto State Forest. The remainder of the course will be given at the college.

Agricultural Experimentation in the Transvaal.—During the past few years there has been a rapid development of experimental work under the auspices of the School of Agriculture and Experiment Station at Potchefstroom. The major fields for this station and its substation at Pietersburg are investigations on problems connected with beef cattle, summer cereals, and fodder crops. Considerable attention is also devoted to experiments in dairying, pigs and poultry, and winter cereals. Field crops experiments, including plant breeding and variety and fertilizer trials, are conducted on an extensive scale. Investigation in the breeding and feeding of animals has recently been considerably increased. Demonstration plats with various grasses and other plants of economic importance such as poisonous plants, saltbushes, Prosopis, etc., are maintained, and experiments conducted in cooperation with farmers are in operation in a number of districts. These experiments serve to provide information under the varying climatic and soil conditions of the area served. Rotations of crops with fertilizers are the commonest features.

Agricultural Meteorology in the British Empire.—The conference of meteorologists of the British Empire held at London from August 28 to September 4 included an agricultural section organized by the British Agricultural Meteorological Committee and presided over by Sir Napier Shaw. In a brief account of the meeting, *The Journal of the Ministry of Agriculture* of October, 1929, states that until this occasion "there had been no gathering at which meteorologists had met agricultural workers of the Empire," notwithstanding the fact that "close cooperation between the two sets of workers is necessary for the solution of problems relating to the effect of weather on the soil, crops, animals, pests and diseases, and agricultural processes generally."

The section meeting was attended by 35 overseas delegates and observers, of whom 21 were agriculturists and 14 were meteorologists and other officers. The British delegates numbered some 80 workers in meteorology, agriculture, and allied sciences. A number of papers dealing with agricultural meteorological subjects were presented, and the conference adopted resolutions favoring the week instead of the month as the unit in summarizing agricultural meteorological data; increased provision for instruction in agricultural me-

teorology and for dissemination of information regarding methods and results of research in the subject; more adequate meteorological observations in connection with experimental and demonstration work, particularly that on cultivation, manuring, and varieties of crops; further studies of the relation of climate and soil to the growth of fruits and their resistance to diseases and pests and to frost damage; studies of causes of variation in number and distribution of wild animals, with special reference to climatic conditions; more thorough study of weather conditions in the immediate vicinity of the growing crop, i. e., local climates; and further development of investigations furnishing a basis for forecasting outbreaks of plant diseases or insect pests and probable yields of crops. It is expected that a full account of the proceedings will ultimately be available.

Second International Soil Congress.—This congress has been arranged to meet partly in Moscow and partly in Leningrad from June 1 to 11, 1930. Following the congress an excursion ending June 27 is scheduled to proceed down the Volga River and through the Caucasus and Ukraine. It is expected that special excursions will also be arranged for those desiring to visit Crimea, Siberia, and central Asia.

New Journals.—*Journal of the Society of Tropical Agriculture* (*Nettai Nôgaku Kwaishi*) is being published monthly by the Faculty of Science and Agriculture of Taihoku Imperial University, Taiwan, Japan. Although mainly printed in Japanese, each original article has at least a summary and other material in English or German. The initial number contains a number of abstracts and the following original articles: On the Studies of the Production Curve, by K. Kimura (pp. 2–13); On the Diagnosis of Certain Plant Infectious Diseases by Means of Serological Reactions, by T. Matsumoto (pp. 14–22); Chalcas, a Linnean Genus Which Includes Many New Types of Asiatic Plants, by T. Tanaka (pp. 23–44); On the Elephant Louse (*Haematomyzus proboscideus*), by M. Sugimoto; The Japanese Rice Crops and World Weather, by K. Shiratori (pp. 50–64); Formosa Rice Crops and Weather Conditions, by K. Shiratori and M. Morinaga (pp. 65–78); The Chlorophyll Content of Japanese and Formosan Rice Stalks, by I. Suzuta (pp. 79–83); A New Determination Method of the Soil Humus, by K. Shibuya (pp. 84–90); and The Injury to the Rice Kernel during Dehulling, by I. Suzuta (pp. 91–101).

Journal of the New Zealand Institute of Horticulture is being issued quarterly at Wellington, N. Z. The initial number contains several original articles, including Chinese Gooseberry (*Actinidea chinensis*), by W. H. Rice (pp. 2–4); Photography as an Aid to the Study of Plants and Plant Problems, by W. C. Davies (pp. 5–15); Horticultural Work for Spring, by W. C. Hyde (pp. 15–20); and Oranges and Lemons in New Zealand, by G. A. Green (pp. 20–22).

Revista Agropecuaria y de Industrias Rurales is being issued monthly by the Stockmen's Society of Paraguay at Asunción. The initial number contains several short articles on agriculture, stock raising, and related fields, including current meteorological observations. Among these articles is one entitled Pests and Diseases of Alfalfa and Methods of Combating Them, by A. de W. Bertoni (pp. 7, 8).

Boletín de Agricultura is being issued semimonthly at Managua as the official organ of the Secretary of Agriculture and Labor of Nicaragua. One of the numerous short articles which make up the initial issue is entitled The Cultivation of Rice, by R. Alonso (pp. 12–17).

EXPERIMENT STATION RECORD

VOL. 61 — DECEMBER ABSTRACT NUMBER — No. 9

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

The modes in which valency is exercised, I, II (*Jour. Soc. Chem. Indus., Brit. Chem. Abs. B, 47 (1928), No. 35, pp. 892–898, figs. 14*).—These two papers present and illustrate a new view of the space chemistry of the carbon compounds.

I. *The tetrahedral carbon atom. Paraffins and polymethylenes*, H. E. Armstrong and W. Barlow (pp. 892–897).—It is shown that full use may be made of the van't Hoff tetrahedron concept of the valency of the carbon atom in conjunction with the hypothesis that valency is a function of the relative volumes occupied by the atoms by assigning to the sphere of influence of unit valency "a definite form irrespective of size. The regular solid nearest in form to a sphere by which space may be filled being a regular rhombic dodecahedron, this is taken as the unit." Solid models built up on this basis are shown to be capable of explaining the structure, crystallization, etc., of the carbon compounds discussed.

II. *The structure of graphite and of black carbon*, H. E. Armstrong (pp. 897, 898).—This is a further application and discussion of the hypothesis outlined in the first paper.

Studies on glutelins.—V, The glutelins of rye (Secale cereale), and of barley (Hordeum vulgare), F. A. CSONKA and D. B. JONES (*Jour. Biol. Chem., 82 (1929), No. 1, pp. 17–21*).—This is a contribution from the U. S. D. A. Bureau of Chemistry and Soils. By means of methods devised to meet the needs of a previously noted investigation (E. S. R., 60, p. 202) of this series, the authors were enabled to isolate from bran-free flour milled from rye (*S. cereale*) a glutelin precipitable from its solution in an aqueous 0.2 per cent sodium hydroxide solution by the addition of ammonium sulfate equivalent to 3 per cent of the saturated solution of the precipitant, and from a flour similarly milled from barley an α-glutelin precipitable by from 1 to 2 per cent, together with a small amount of a β-glutelin precipitable by 18 per cent of the saturation quantity of ammonium sulfate.

The rye glutelin had the elementary composition, carbon 53.05 per cent, hydrogen 6.35, sulfur 1.12, and nitrogen 16.72 per cent, with the basic amino acids cystine 2.56, arginine 7.07, histidine 2.75, and lysine 5.39 per cent, as determined by the Van Slyke method (E. S. R., 26, p. 22), and an isoelectric point at pH 6.2. The elementary analysis of the α-glutelin of barley showed carbon 54.31 per cent, hydrogen 6.94, sulfur 1.21, and nitrogen 16.16 per cent, the content of cystine found in this protein having been 3.10, of arginine 5.59, of histidine 1.09, and of lysine 2.88 per cent; while the isoelectric point was found at pH 6.4.

The similarity in chemical composition between these glutelins and the a-glutelin of wheat led to the tentative conclusion that the characteristic dough-forming property of wheat flour does not depend upon the chemical composition of its glutelin content, since this property is not shared by rye flour or by barley flour.

Studies on gossypol, V, VI, E. P. CLARK (*Jour. Amer. Chem. Soc., 51 (1929), No. 5, pp. 1475–1483, fig. 1*).—These two contributions from the Food Research Division of the U. S. D. A. Bureau of Chemistry and Soils continue a series already noted (E. S. R., 61, p. 9), presenting an account of the author's further researches on the structure of gossypol and of apogossypol as follows:

V. *The action of chromic acid upon some gossypol derivatives* (pp. 1475–1478).—Work noted in the earlier contributions of this series having indicated the necessity for the production of the hydroxyl groups both of gossypol and apogossypol prior to any attempt to learn anything of the structure of these compounds through their oxidation products, the author acetylated both gossypol and apogossypol, obtaining in each case the hexa-acetyl derivative, and, from apogossypol, prepared also a hexamethyl ether. He then subjected the three componnds to oxidation with chromic acid in aqueous sulfuric acid. Hexa-acetylgossypol yielded a compound designated tetra-acetylgossypolone, two of the acetyl groups having been replaced by two quinone groups with the formation of the tetra-acetyl derivative of a quinone containing 5 less carbon atoms and 8 less hydrogen atoms in its molecule than does gossypol itself.

Hexa-acetylapogossypol was similarly oxidized to a quinone with the loss of two acetyl groups, the actual oxidation product having been designated tetra-acetylapogossypolone. Apogossypolone itself possesses, therefore, 6 less carbon atoms in its molecule and 10 less hydrogen atoms than does apogossypol.

The hexamethyl ether of apogossypol lost, on oxidation with chromic acid, two methoxyl groups, with the formation of two quinone groups, together with two hydrogen atoms, by the oxidation of which a further two quinone groups were produced, so that the oxidation product had the empirical formula $C_{28}H_{24}O_8$, and was the tetramethoxy derivative of a tetraquinone of the empirical composition $C_{28}H_{30}O_8$.

VI. *The action of boiling hydriodic acid as used in the Zeisel method upon gossypol and some of its derivatives. A semi-micro Zeisel methoxyl method* (pp. 1479–1483).—Difficulty having been encountered in the course of the work just noted in the determination of the methoxyl groups in various methylated derivatives of gossypol—especially in tetramethoxypseudogossypolone, which gave practically no silver iodide in the Zeisel procedure but a very high result in the Weishut-Zeisel method in which phenol is added with the hydriodic acid—a systematic investigation of the determination as applied to gossypol derivatives was made with the result of the development of a method for the determination of methoxyl groups in samples of the order of 20 mg. The ordinary analytical balance took the place in this procedure of the microbalance demanded by the Pregl form of macro-Zeisel method.

As a possible explanation of the behavior of alkoxyl-free gossypol derivatives in procedures of the Zeisel type, it is suggested that in the Weishut-Zeisel method the gossypol molecule may be so disrupted as to yield an alkyl iodide, or possibly methylene iodide from formaldehyde and hydriodic acid, but certainly not methyl iodide.

The composition of the fatty acids of palm oil, A. RAYNER and S. G. CAMPBELL (*Jour. Soc. Chem. Indus., Trans., 47 (1928), No. 20, pp. 149T, 150T*).—From figures obtained in the examination of palm oils from nine somewhat widely separated sources the conclusion was drawn that the somewhat extensive

variation in the titer and iodine value shown in the data tabulated are due rather to variations in the total quantity of the solid acids than to any important variation in the composition of the fraction. The solid acids contained from 12.5 to 18.5 per cent of stearic acid. The liquid acids were estimated on the basis of the iodine value to contain as an average 20 per cent of linoleic acid and 80 per cent of oleic acid. The authors found the Twitchell lead salt-alcohol method to be both the quickest and the most reliable procedure for the separation of the solid from liquid acids, and the figures here given were all obtained by the lead salt-alcohol procedure.

A study of the lignocellulose of Victorian mountain ash (Eucalyptus regnans), H. W. Strong (*Jour. Soc. Chem. Indus., Trans., 47 (1928), No. 14, pp. 87T–90T, figs. 2*).—For the determination of the cellulose in *E. regnans* it was found necessary first to extract the sample with sodium hydroxide, best by heating the sample at the boiling temperature with a 1 per cent sodium hydroxide solution. More concentrated alkali gave lower yields of total cellulose and a smaller proportional quantity of α-cellulose. The quantity of chlorine reacting with the lignone to form hydrochloric acid was found to be approximately twice the quantity (7.5 to 8 per cent of the oven-dried material) which combined with the lignone.

Experiments on the behavior of lignin in the natural decomposition of plants [trans. title], F. Fischer and R. Lieske (*Biochem. Ztschr., 203 (1928), No. 1–6, pp. 351–362, figs. 2*).—In a study of a wide range of materials it was found that in the decomposition of plant substances under natural conditions the process begins with the breakdown of the hydrolyzable constitutents, while lignin substances accumulate as the decomposition proceeds. For the substance of ferns, said not to have been investigated heretofore with respect to the rate and nature of its decomposition in the soil, the same statements were found to hold good. Contrary to the view, stated to have been expressed repeatedly, that the microscopic structure of wood is destroyed with the breakdown of the cellulose, the authors of the present paper found it possible to show in the case of a decayed fir wood [Fichtenholz], nearly free from cellulose if not entirely so, that the structure had been retained to the finest detail. The opinion is noted that wood structure in coal does not, in view of the finding last named, conflict with the lignin theory.

A further result of the experiments was the observation that in the decomposition of plant material under natural conditions the H-ion concentration is increased less than in pure cultures of the fungi, the acids initially formed being removed under natural conditions by leaching or by the action of microorganisms to such an extent that even acid-sensitive bacteria are enabled to take part in the further decomposition of the wood.

Photomicrographs of a transverse and of a radial longitudinal section of the decayed pine wood mentioned above (magnification × 100) are reproduced and show the character of the microstructure remaining after the practically complete destruction of the cellulose. It is noted that 85.55 per cent of the total mass of this material was found to consist of lignin.

A study of the chemical relationship of the various pectic substances (*Maryland Sta. Rpt. 1928, pp. XX, XXI*).—In a study of the development of alcohol-soluble pentosans concurrent with the formation of pectins in ripening fruits, the detection in ripe apples, bananas, and strawberries of an alcohol-soluble substance yielding furfural on distillation with 12 per cent hydrochloric acid after the removal of alcohol-soluble sugars by the action of washed yeast is reported as the work of C. M. Conrad. The colorimetric method of Fleury and Poirot (E. S. R., 48, p. 11) was used for the furfural determination.

In bananas and in strawberries the quantity of the furfural-yielding substance increased concurrently with that of the pectins during the ripening of the fruit.

The acids of figs, E. K. NELSON (*Jour. Amer. Chem. Soc., 50 (1928), No. 7, pp. 2012, 2013*).—Reporting an investigation of the U. S. D. A. Bureau of Chemistry and Soils, this paper describes the isolation of acetic and citric acids from Adriatic figs, and of acetic, citric, and a small quantity of malic acid from Calimyrna figs. Adriatic black neck figs contained more than 10 times as much free acetic acid as did normal Adriatic fruit, while the citric acid was below normal. In Calimyrna figs affected by internal rot the free acetic acid was nearly twice that of the normal fruit, the citric acid figure having been slightly less than that obtained for the normal Calimyrna figs.

The acids of maple sirup, E. K. NELSON (*Jour. Amer. Chem. Soc., 50 (1928), No. 7, pp. 2006–2008*).—Samples of 10 gal. each of maple sirup from Vermont and Michigan were examined in the U. S. D. A. Bureau of Chemistry and Soils with a view to the isolation and identification of acids contained in them. In addition to malic acid, known to be the fermenting acid in maple products, formic, acetic, and citric acids were identified, together with a small quantity of fumaric acid and a trace of succinic acid. Evidence was obtained also of the presence in small quantities of an unidentified acid of high melting point. Tricarballylic acid and *d*-tartaric acid, of both of which traces had been identified in maple sugar "sand," were not found in the sirup.

The flavor of maple sirup, E. K. NELSON (*Jour. Amer. Chem. Soc., 50 (1928), No. 7, pp. 2009–2012*).—Investigating the flavor constituents of maple sirup, the author of this contribution from the U. S. D. A. Bureau of Chemistry and Soils, obtained an unstable phenolic substance upon which is largely dependent the flavor of maple sirup, together with a crystalline aldehyde melting at from 74 to 76° C. and similar in odor and properties to vanillin. The sirup was found to contain traces of other aldehydic substances which affect the flavor.

The phenolic substance was destroyed by alkalis, and when removed from the sirup by norite it was either destroyed in the process or failed to redissolve when the norite was exhausted with ether. Only a red oil having but an indistinct maple odor was extracted by ether from the norite.

Utilization of onions by canning, C. P. JONES (*Massachusetts Sta. Bul. 247 (1929), pp. 328, 329*).—Analyses of the blanched edible portion of the onion showed, on the basis of the green material with a water content of from 84 to 90 per cent, a percentage of total sugars approximately amounting to from 5 to 11 per cent, a protein content ranging from about 2 to 2.5 per cent, with smaller quantities of fat and crude fiber. The substantial differences in the quantities of the components determined were those between the compositions of seed and set onions, between which differences were observed not only in the moisture, sugar, and protein contents, but in the ash content also, in the alkalinity of the ash, and in the total sulfur. Both the calcium and the magnesium contents of the two forms of material were the same.

In addition to allyl sulfides mustard oil was found to be apparently a constituent of onions. Onions were also found to contain a flavonol pigment.

The effect of pure soaps on the bactericidal properties of phenolic germicides, B. HAMPIL (*Jour. Bact., 16 (1928), No. 5, pp. 287–300*).—This contribution from Johns Hopkins University presents evidence of a marked inhibition by sodium oleate, sodium myristate, potassium palmitate, and potassium stearate upon the bactericidal effectiveness of phenol, metacresol, secondary butyl phenol, *n*-butyl resorcinol, and *n*-hexyl resorcinol. A more or less quantitative relationship could be demonstrated, and it is concluded that it would not

be possible to produce, by the addition of small quantities of phenolic compounds to soap, an actually germicidal product. It is noted further that the addition of quantities of phenolic disinfectants sufficient to give the product an actually germicidal character is precluded by the prohibitive cost of manufacture of any but the more crude and irritating types of phenolic compounds, so that phenols as a group must be regarded as unsuitable for use as the active agent in germicidal soaps.

The germicidal effectiveness of the phenols studied was decreased to a greater extent by the disperse phase than by the gel phase of the soaps used. The soaps appeared to interfere with the bactericidal effect of the phenols by removing these compounds from aqueous solution.

Burette-reading device, M. HYMAN (*Jour. Soc. Chem. Indus., Trans.*, 47 (1928), No. 14, p. 100T, fig. 1).—The instrument described is constructed as follows:

A slip of white celluloid approximately 3 in. in length and 1.5 in. in width is colored black up to a straight line about 0.5 in. from and parallel with the upper long margin. A straight-edged slip of transparent celluloid is attached at the ends of the black and white slip so that it covers the blackened area and has its edge exactly coincident with the edge of the black section. The device is slipped over the burette with the transparent piece in front and in contact with the graduations, and is viewed in reading the burette in such a way as to bring the upper edge of the transparent front piece and the upper edge of the black strip into coincidence, with the bottom of the meniscus tangent to the edge of the black section. The reading is thus taken without the possibility of parallax, and the front section, because of its transparency and direct contact with the graduations, both permits a very accurate reading and records this reading until the device is moved.

"The efficiency of the device was tested by asking nine observers to read the same burette independently, with the result that seven gave the reading as 6.03 and two gave it as 6.02 cc."

The activity coefficients of certain acid-base indicators, J. SENDROY, JR., and A. B. HASTINGS (*Jour. Biol. Chem.*, 82 (1929), No. 1, pp. 197–246, figs. 7).—Using electrometric measurements in comparison with color readings made against bicolor standards, the authors of this contribution from the Rockefeller Institute for Medical Research studied the effect on the activity coefficients of bromocresol green, of bromocresol purple, and of phenol red brought about by the salts sodium chloride, potassium chloride, sodium sulfate, potassium sulfate, magnesium chloride, calcium chloride, and magnesium sulfate by acetate and phosphate buffer mixtures and by glucose.

As in the case of other weak acids in the presence of their salts, the value of the quantity pK′ was found dependent upon the total electrolyte content of the solution. The alteration of the color of an indicator by the addition of a neutral salt is ascribed to this cause. Correlating the salt effects with ionic strengths, the authors found that "salts of different valence types show at the same ionic strengths approximately like effects on the pK′ of the indicator." The results were considered to indicate further, however, that factors other than the ionic strength, though of less magnitude, also influence the relationship between the p_{aH^+} and the color of the indicator, these lesser factors including differences in specific interionic effects; but "such effects are, however, in most cases relatively slight compared with the main, nonspecific effect indicated by the ionic strength."

Tables and equations taking into account the possible variations in the salt content either of the sample or of the standards and providing a correction

also for the ratio in which are present the alkaline and the acidic forms of the indicator are given for the colorimetric determination of p_{aH^+}.

The results obtained are discussed with reference to their relation to various phases of the recent work on colorimetric estimations of p_{aH^+}.

A simple reference electrode for potentiometric titrations, H. H. Willard and A. W. Boldyreff (*Jour. Amer. Chem. Soc., 51 (1929), No. 2, pp. 471–474, fig. 1*).—The construction of the device described in this contribution requires only the sealing through the wall of the tip of the burette of a short piece of bright platinum wire of convenient size. Liquid junction is established by dipping the tip of the burette into the solution to be titrated.

A constancy of potential sufficient to make accurate titration possible was demonstrated for oxidation-reduction, for neutralization, and for precipitation reactions. The largest discrepancy shown was that of 0.05 c. c. of N/10 potassium bromate in the titration of 25 cc. of arsenious acid.

The potentiometric titration of ammonia, E. B. R. Prideaux (*Jour. Soc. Chem. Indus., Trans., 48 (1929), No. 16, pp. 87T, 88T*).—Noting that the impossibility of using the hydrogen electrode in the titration of ammonia and the impracticable nature of the mercury-mercuric oxide electrode have delayed the application of potentiometric methods to the titration of ammonia, the author proposes the quinhydrone electrode as capable of meeting the situation provided the titration be made from the acid side. The end point of such an ammonia titration occurs approximately at pH 5, well within the useful range of the quinhydrone electrode.

Experimentally, the ammonia to be titrated was treated with a known excess of hydrochloric acid and the excess determined by electrometric back titration with the quinhydrone electrode as indicator, the bridge solution having been a saturated potassium chloride solution and the calomel half cell of the saturated type. The sharpness of end point was found to be such as "to justify the highest attainable accuracy in the measuring instruments."

The determination of carbon and carbon dioxide, T. E. Friedemann and A. I. Kendall (*Jour. Biol. Chem., 82 (1929), No. 1, pp. 45–55, figs. 3*).—The so-called wet combustion method, involving the use of chrominm dioxide as oxidizing agent, was found capable without the assistance of such catalysts as silver or mercury of a quantitative oxidation even of such materials as acetic acid and fats, "provided proper attention is paid to the total acid concentration," and the advantages of the wet method over the dry combustion for the determination of total carbon in materials of biochemical importance are noted. An apparatus and technic for the carrying out of the method in the form found to deal satisfactorily with the types of organic material tested is described in full constructional and operative detail.

The following substances were found to be oxidized with the recovery of from 98 to 100 per cent of the carbon dioxide representative of the total carbon content: Acetic acid, ethyl alcohol, crotonic acid, β-hydroxybutyric acid, lactic acid (lithium salt), potassium hydrogen saccharate, sugars (sucrose, glucose, galactose, and rhamnose), methylamine HCl, alanine, aspartic acid, uric acid, urea, dimethylglyoxime, chinchonine, potassium hydrogen phthallate, benzoic acid, hydroquinone, and piperine. Stearic acid and carbazole could not be kept quite entirely in contact with the reagent and gave results representing from 98 to 99 per cent of their respective total carbon contents.

Emphasis is laid upon excessive proportions of water to sulfuric acid as causes of failure in previous studies of the method, and the effect of various dilutions with water upon the oxidation of acetic acid, of alanine, and of casein is graphically shown.

A new procedure for the determination of tryptophane and tyrosine in proteins by the quantitative carrying out of the xanthoproteic reaction; and the application of this to most important protein types of our food materials [trans. title], J. TILLMANS, P. HIRSCH, and F. STOPPEL (*Biochem. Ztschr., 198 (1928), No. 4-6, pp. 379-401, figs. 2*).—An essentially colorimetric method based upon the assumption that tyrosine and tryptophane, and only these amino acids, react with nitric acid to form yellow nitrocompounds, is discussed and the working details of the method are indicated. The figures obtained for the tyrosine and tryptophane contents of a large number of proteins occurring in food materials of various sorts are tabulated in comparison with the results obtained by other investigators whose determinations here cited represent a considerable variety of methods. The discrepancies indicated vary from slight to very marked differences. The analytical work is described in the case of each substance examined in considerable detail.

The use of molybdic acid as a precipitant for blood proteins, S. R. BENEDICT and E. B. NEWTON (*Jour. Biol. Chem., 82 (1929), No. 1, pp. 5-10*).—This contribution presents the results of a comparison of molybdic acid with tungstic acid as a precipitant for proteins, with reference especially to blood analysis.

Molybdic acid was found capable of replacing tungstic acid entirely in the precipitation of the blood proteins. The molybdic acid filtrates were shown to be suitable for the determination of thionine, as well as for that of the nonprotein blood constituents determinable in tungstic acid filtrates. It is noted, however, that "it should be borne in mind that when molybdic acid is used as the blood protein precipitant, direct uric acid determinations will be very materially too high, due to the larger amount of thionine in such filtrates." Means for avoiding such high results are indicated.

A note on the purification of picric acid for creatinine determination, S. R. BENEDICT (*Jour. Biol. Chem., 82 (1929), No. 1, pp. 1-3*).—The working details of two methods are given, the first depending upon the direct recrystallization of dry commercial picric acid from glacial acetic acid. The second method, said usually to give a product testing slightly better in the colorimeter than does that of the glacial acetic acid recrystallization, involves the conversion of the acid into the sodium salt by solution in aqueous sodium carbonate solution and the reconversion of the crystallized sodium picrate into the free acid by the washing of the crystals on the filter with a mixture of one part of hydrochloric acid with four parts of water.

It is noted that this second procedure involves the handling of large volumes of solutions, but permits the direct use of the moist commercial picric acid and gives "a good percentage recovery" of the purified acid.

Hydrogen-ion determination in flour and bakery products, E. O. WHITTIER and E. GREWE (*Cereal Chem., 6 (1929), No. 3, pp. 153-162*).—The H-ion concentration of a 100-cc. extract of a 20-gm. sample of a flour, cake, or bread was found by the authors of this contribution from the U. S. D. A. Bureau of Dairy Industry to differ from that of the unextracted sample, the Bailey electrode and the capillary quinhydrone electrode having given, according to the conclusions here presented, "results that may in general be safely used for comparative purposes but should not be considered the true values for the unextracted samples."

A procedure designated the ball method and designed to eliminate dilutions sufficient to affect significantly the pH figures obtained consisted in rubbing in a glass mortar from 3 to 5 gm. of the material with a quantity of quinhydrone sufficient to give the mixture a gray black color, and water enough (more than 1 cc. for 5 gm. of the substance was never required) to produce a

mass capable of being molded about the electrode, after which the tip of the ball of dough was placed in contact with the saturated potassium chloride bridge solution and the reading against a saturated calomel half cell taken by means of a potentiometer in the usual way. This method gave "readily reproducible pH values when applied to flours and bakery products in the range 5.0 to 8.0," and was found comparatively rapid. "The values so obtained more nearly represent the true H-ion concentration of the samples than those obtained by the other methods discussed."

Modifications of Rumsey's method for the determination of diastatic activity in flour, J. G. MALLOCH (*Cereal Chem.*, *6 (1929), No. 3, pp. 175–181*).—It is proposed that Rumsey's method (E. S. R., 48, p. 504) be modified to include control of the H-ion concentration by the use of a Sorenson citrate hydrochloric acid buffer mixture found capable of holding flour suspensions to a pH value of about 4.65, a correction for the volume of the flour (the average volume occupied by 10 gm. of flour in the suspension used in this method was found to be 7 cc.), and an improved procedure for the determination of the blank.

The determination of the blank was found one of the most important sources of error in the original form of Rumsey's method, the omission from the procedure for the blank determination of the 0.4 cc. of concentrated sulfuric acid added in the main determination with the sodium tungstate clarification reagent, as directed in the original form of the method, having led to a value for the blank determination so much too high as clearly to indicate incomplete activation. Full directions for the preparation of a diastase-free flour are given, and the possibility of the hydrolysis either of starch or of soluble carbohydrates to an extent such as to affect appreciably the quantity of the reducing sugars capable of reducing the copper solution was studied with the result of eliminating such reactions from consideration as sources of significant error.

Factory tests for dairy products, D. R. THEOPHILUS (*Idaho Sta. Circ. 53 (1929), pp. 8*).—This circular consists of a collection of concise directions, practically without comment, for dairy products tests as follows:

The Babcock tests for milk, cream, skim milk and buttermilk; the American Association test for buttermilk; the acid tests of Mann and of Farrington; the rapid estimation of milk or cream acidity; the alcohol test; the methylene blue reduction test; the sediment test; the specific-gravity and total-solids test; and a series of tests for butter, for cheese, and for ice cream, the last-named group including two forms of the Babcock test adapted for the estimation of the milk-fat content of milk powders.

METEOROLOGY

Agricultural meteorological scheme precision records on wheat at Wye, W. L. FIELDING and R. LINE (*Jour. Southeast. Agr. Col., Wye, Kent, No. 25 (1928), pp. 242, 243, figs. 2; 26 (1929), pp. 89–95, fig. 1*).—A plan of observations on the progress of germination, leaf formation, early tillering, dying of side tillers, ear emergence, and yield as related to weather and other conditions is described, and the first year's results are reported. The plan is based on recommendations of the Agricultural Meteorological Committee of the Ministry of Agriculture and Fisheries.

What increase in temperature of soil is brought about by snow cover? [trans. title], K. OPITZ (*Fortschr. Landw., 4 (1929), No. 8, pp. 225–227, figs. 6; abs. in Deut. Landw. Rundschau, 4 (1929), No. 2, p. 131*).—Observations are reported which showed considerably higher temperatures and smaller fluctuations of temperature under snow cover than in bare soil or in the air.

The influence of climate on the agriculture of Thuringia, R. SCHMIEDER (*Der Einfluss des Klimas auf die Landwirtschaft in Thüringen. Inaug. Diss., Univ. Leipzig, 1928, pp. 119*).—The climatography and climatology of Thuringia are discussed in their relation to the utilization of the soil for crop and animal production and to farm management.

SOILS—FERTILIZERS

Soil survey of Fannin County, Georgia, S. W. PHILLIPS and J. W. STEPHENSON (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.], Ser. 1923, No. 7, pp. 177–200, fig. 1, map 1*).—Fannin County consists of 252,800 acres of steeply rolling, hilly, and mountainous lands in northern Georgia. The drainage conditions of this area include both an excessive drainage noted in the cases of a number of the soil types described, and inadequate natural drainage in stony bottom lands where "the scarcity of level land would seem to warrant the cost of installation of tile drains."

Talladega silt loam 39.2 per cent, Porters loam 19.3 per cent, and Porters stony loam 14.4 per cent of the total area have the largest individual acreage areas among the 9 series of 13 types listed. Of rough stony land 4.3 per cent only is listed, but it is noted that "rough stony land, Talladega slate loam, Fannin stony loam, Porters stony loam, Ashe silt loam, and Ranger silt loam" (in all 30.1 per cent of Fannin County) are all "soils whose topography and stony character preclude their use except in local spots for agricultural purposes."

The soils of a second group are "rolling to hilly and semimountainous" (65.5 per cent) but can be used for general farming, grazing, and the growing of vegetables and apples, while a third group (4.4 per cent) is nearly all under cultivation and productive.

Douglas County soils, R. S. SMITH, E. E. DETURK, F. C. BAUER, and L. H. SMITH (*Illinois Sta. Soil. Rpt. 43 (1929), pp. [2]+54, pls. 2, figs. 8*).—Douglas County, Ill., is located in the east-central part of the State and in the southern end of the most recent glaciation. The county possesses an area of 265,287 acres, of which 87 per cent was found to be covered by productive dark prairie soils. Except for morainal ridges in the northeast and southeast, the area is comparatively level. Drainage is provided mostly by the Kaskaskia and Embarras River systems.

The soils of Douglas County are here mapped and described in four main groups, of which the upland prairie soils, covering a total of 87.24 per cent of the entire county and including the three largest individual types, a brown silt loam 55.81 per cent of the total area, a black clay loam 16.73 per cent, and a drab clay loam 14.60 per cent, account for the more important type areas found, the next in order of areal extent being a yellow-gray silt loam, 9.51 per cent, in the upland timber soil group. The group designated swamp and bottom-land soils comprises a total of but 2.89 per cent of mixed loam and deep peat.

An appendix to this report takes up the usual interpretation of the soil survey and the principles of soil fertility, and data from six experiment fields form a supplement.

Soil survey of Iowa—Harrison County, W. H. STEVENSON, P. E. BROWN, ET AL. (*Iowa Sta. Soil Survey Rpt. 55 (1929), pp. 72, pls. 2, figs. 6*).—Harrison County, Iowa, is in the southwestern part of the State and has an area of 442,240 acres of which 94.3 per cent is farm land. The surface is characterized by rounded ridge tops and smooth gentle slopes to stream channels, and drainage is provided by the Missouri River and its tributaries.

The soils mapped in Harrison County are here classified as 11 series inclusive of 24 types, and are further grouped into 4 origin classes of which the

loess soils, 52.5 per cent of the entire county, are the most extensive and include much the largest type area, Marshall silt loam 45.8 per cent. The bottom-land soil Wabash silt loam, 15 per cent, is next in areal importance.

The soils of Missouri, M. F. Miller and H. H. Krusekopf (*Missouri Sta. Bul. 264 (1929), pp. 120, figs. 65*).—This is a revised and enlarged reissue of Bulletin 153 (E. S. R., 39, p. 813).

Alkali soils (*Idaho Sta. Bul. 164 (1929), p. 10*).—Field work consisted in the determination of pH values and the taking of crop counts and water table readings, while in the laboratory the soils under investigation were further examined with respect to pH and were analyzed also for colloid content and for salts. The physical and chemical constants were found to correlate rather closely with the crop records. Of the chemical changes noted the conversion of carbonates to bicarbonates showed the closest correlation with crop growth. A perched water table, requiring improvement of drainage conditions, appeared to have retarded the action of reclamation chemicals.

At Banida, as shown both by crop yields and by the salt content, the soil responded readily to drainage treatment.

These studies were made in cooperation with the U. S. D. A. Bureau of Public Roads.

Isolation and study of the nitrifying bacteria (*Idaho Sta. Bul. 164 (1929), p. 23*).—The use of the known selective bactericidal action of certain dyes was extended by the application of rosaniline hydrochloride to the purpose of the elimination of the two most undesirable contaminants of cultures of the nitrite oxidizing organism. Impure cultures of this organism exposed for from 5 to 30 minutes to the action of a 1 per cent solution of the dye contained but one contaminating species, from which the organism of which pure cultures were required could be separated by picking the colonies from the surface of washed agar plates.

Note is made of a preference for the term "nitrite oxidizing organism" in referring to the organism as against the term "Nitrobacter."

Nitrogen-fixation in relation to legumes and nonlegumes under defined agronomic conditions, J. E. Fuller (*Massachusetts Sta. Bul. 247 (1929), p. 305*).—An experiment dealing with nitrate relations in soils planted to legumes with and without nitrogenous fertilizers, fertilized but without legumes, and neither planted to legumes nor fertilized gave results so inconsistent as to lead to a microbiological investigation of the soils used, and the discovery of a new Azotobacter form, designated Azotobacter 9A, together with the isolation among other organisms of several strains of Actinomyces.

The new Azotobacter form was shown to possess a definite nitrogen-fixing power. The Actinomyces strains showed a tendency, when grown in an artificial culture medium with the new Azotobacter 9A or with other Azotobacter forms, to utilize the nitrogen fixed by the last-named species.

Nitrogen fixation in the presence of or as a result of the growth of legumes versus nonlegumes under certain defined agronomic conditions, F. W. Morse (*Massachusetts Sta. Bul. 247 (1929), pp. 327, 328*).—The crop successions and yields in this investigation, of which the microbiological progress report has been noted above, are here concisely stated and tabulated. Nonlegume plats, although without nitrogen applications since 1882 or earlier, have not deteriorated in the 5 years of this experiment "and in 1927 and 1928 were even superior in weights of dry matter and nitrogen removed in the crops."

Physiological studies of cellulose fermentation, J. R. Sanborn (*Jour. Bact., 16 (1928), No. 5, pp. 315–319*).—A culture medium containing the dyes

China blue and aurin, together with cellulose, was found valuable in the study of cellulose-destroying soil bacteria, isolations both by the streak and pouring plate methods having been possible when the solid form of the medium was used.

Microbial associations could be studied with some effectiveness by the method described, and it was found that the China blue-aurin-cellulose agar medium gave excellent results also with soil fungi, the medium yielding a method for the securing of "a very satisfactory criterion for the cellulose-destroying abilities of these organisms." In one experiment, the results of which are here indicated, the addition of yeast to a culture of this medium of a *Cellulomonas* sp. resulted in an association whose effect was to initiate and carry on the attack upon the cellulose distinctly more rapidly than in the case of the pure culture of Cellulomonas sp.

Fertility of coniferous timber soils (*Idaho Sta. Bul. 164 (1929), p. 11*).—In a microbiological study of Helmer silt loam as affected with respect to ammonification, nitrification, and carbon dioxide production by the turning under of crops or roots of crops of oats, wheat, red clover, alfalfa, and sweetclover, counts of bacteria and molds indicated that the crops named had an effect increasing in the order in which the crops are listed. Alfalfa just maintained normal activity, but the sweetclover gave an increase.

In the comparison of a cultivated with a virgin soil, the cultivated was during the first few days the more active both in carbon dioxide production and in ammonification, but the relation was soon reversed and the cultivated showed the lesser total activity for the 77-day period as a whole. Nitrification was increased more rapidly in the cultivated soil, but was slowly increased also in the virgin soil, especially by the sweetclover and by alfalfa residues.

Lime applications, 1 or 4 tons to the acre, "had little effect above the carbon dioxide equivalent to complete neutralization of the calcium carbonate applied."

[Soil fertility studies in Nebraska] (*Nebraska Sta. Rpt. [1928], pp. 16–18*).—These studies continue earlier work (E. S. R., 59, p. 816).

Relation of weather, cultural practices, and soil conditions to nitrification in Nebraska soils.—Experiments were made on 10 fields in 10 farms, the soil nitrate content of which ranged from 64.5 to 7.9 lbs. to the acre and the loss of organic matter from less than 30 to as much as 66 per cent.

Increases in the yield of wheat varying between −2.44 and 15.92 bu. were secured from the sodium nitrate plats and between 0.75 and 5.05 bu. an acre from the ammonium sulfate plats. "The response to sodium nitrate was quite consistent with the nitrate content of the soil at the time of application and with the ability of the soil to produce nitrates during the growth of the crop."

Sodium nitrate applications on the agronomy farm at various times indicated the importance for wheat of a high soil nitrate content in early April. April applications of ammonium sulfate were of little effect. More than three-fourths of the nitrogen required by the wheat crop was found apparently to be absorbed before the middle of May. The fall application of manure, which hastened nitrate production, increased the yields of wheat.

Soil organic matter.—The present report notes the study of the loss of soil organic matter in 68 fields. Of these 9, under cultivation for from 5 to 7 years, showed an average loss of 6.5 per cent of organic matter; 9 fields of from 8 to 15 years' cultivation, a loss averaging 14.5 per cent; 12 fields, cultivated for from 17 to 30 years, an average loss of 25.6 per cent; while 25 fields which had been under cultivation for from 32 to 45 years had lost an average of 26.2 per cent, and 12 fields, from 46 to 60 years under cultivation, had undergone an

average loss of 28 per cent of their organic matter, all these figures representing lands handled without special attention to soil maintenance. The average loss was but 6.5 per cent during from 30 to 47 years in 9 fields upon which manure had been applied or legumes grown. On the other hand, in 15 fields cultivated for from 30 to 60 years, but all more or less eroded, the average loss reached 56 per cent.

Soil acidity and liming.—The greatest benefit from liming appeared to have occurred in soils of which the content of organic matter had been badly depleted and the pH value reduced to less than 6.2. In soils of relatively high content of organic matter lime appeared not to be needed regardless of the pH value.

Preliminary report on two years' fertilizer experiments with early Irish potatoes on the farm of A. W. Baker, Aurora, Beaufort County, North Carolina, J. J. SKINNER, C. B. WILLIAMS, and H. B. MANN (*North Carolina Sta. Agron. Inform. Circ. 29 (1929), pp. 5*).—In an attempt to ascertain the value of varying quantities of fertilizers of different analyses, the results of two successive crop years did not agree upon the same formula. The 2,000-lb. rate of application of each of the three formulas tested gave better results than did rates either of 1,600 or of 2,400 lbs.

In the test of sources of potassium the chloride was the most satisfactory, potassium sulfate was less satisfactory in the second year, and in both years manure salts gave results poorer than those obtained from either of the other sources of potassium.

The results of the nitrogen rate tests of the two years reported did not agree. In the first year the yields were found to increase with the nitrogen content of the fertilizer up to that of a 10–6–5 N–P–K, beyond which the test was not carried; but in the second year 8–6–5 and 10–6–5 did no better than did 6–6–5. Used as the sole nitrogen source, nitrate of soda and sulfate of ammonia have given practically equal yields, both having been exceeded by Leunasalpeter, urea, and ammonium phosphate.

This work was carried on in cooperation with the U. S. D. A. Bureau of Chemistry and Soils.

The fertilizer triangle, F. E. BEAR (*Indus. and Engin. Chem., 21 (1929), No. 4, pp. 382–385, figs. 13*).—The use of an equilateral triangle of which each apex represents, respectively, 100 per cent of nitrogen, of phosphoric acid, or of potash is considered. It is stated that "the problem involved is that of spacing the ratios in the triangle in such a manner as to cover the field equally well at all points. By drawing a series of nine equally spaced lines parallel to each side of the triangle, the intersecting points of these three series of lines may be so located that they accomplish the purpose desired. Such a system of selecting the ratios is particularly important in connection with the movement from low to high and to concentrated analyses. Its use is urged for consideration by those concerned with the development of the fertilizer industry as a means of simplifying the program of standardization and eliminating confusion on the part of the consumer."

The manner in which the fertilizer triangle may be used in practical experimental work is discussed, and the position on this diagram of the ratios adopted at regional conferences of the New England, Central, Atlantic Coast, and Southeastern States are shown.

Computation of no-filler fertilizer mixtures, A. B. BEAUMONT and H. R. KNUDSEN (*Indus. and Engin. Chem., 21 (1929), No. 4, pp. 386–388, figs. 5*).—This discussion of the mathematics of the more complicated cases in the computation of the quantities required in the preparation of fertilizer mixtures

The simples type of problem involved in the calculation of fertilizer formulas—that of a mixture of three single-element components—may be solved by the simple arithmetical method, but in the five other cases here discussed—those, namely, of mixtures of four or more single-element components, of one double-element component and one single-element component, of one double-element and two or more single-element components, of two or more double-element components with one or more single-element components, and finally of three or more double-element components—arithmetical computations are shown unnecessarily to involve trial and error procedure of increasing complexity and tediousness. The triangular systems of Merz and Ross (E. S. R., 52, p. 324) and of Colbjörnsen (E. S. R., 56, p. 119) were found useful for ascertaining the ratio possibilities of many materials but inadequate for the computation of no-filler mixtures.

As a general solution of the problems presented by no-filler mixture components more complex than the case of the three single-element components, therefore, an algebraic method based upon the use of simultaneous equations of two or more unknowns was developed and is here discussed with reference to each of the types of more difficult computation noted above, with illustration wherever necessary by the solution of specific examples.

The analysis is concluded with a discussion of the determination of possible ratios, illustrated by four examples of the choice of possible components and the calculation of the quantities required in the preparation of an 8–20–12 (N–P–K) mixture. In example 1, it is shown to be determinable by inspection from a graphic figure of the triangular type that the 2 : 5 : 3 ratio is possible with the components sodium nitrate (15.5 per cent N), Ammophos (11 per cent N, 48 per cent P_2O_5), potassium chloride (50 per cent K_2O). On solution of the algebraic equations for the actual quantities, however, a negative figure for one of the unknowns shows that although the ratio 2 : 5 : 3 is possible, its multiple 8–20–12 is not possible with the components named. Example 2 shows that by the addition of superphosphate (16 per cent P_2O_5) to the other components, an 8–20–12 mixture can be made without filler from 505.1 lbs. sodium nitrate, 742.4 lbs. Ammophos, 272.5 lbs. superphosphate, and 480 lbs. potassium chloride. Example 3 shows a tankage of 9 per cent nitrogen and 5 per cent phosphoric anhydride content to provide a principally organic no-filler mixture of the same formula.

It is noted that in general single-element components widen the ratio possibilities, whereas double-element components increase the no-filler possibilities.

Hygroscopicity of fertilizer materials and mixtures, J. R. Adams and A. R. Merz (*Indus. and Engin. Chem.*, *21* (*1929*), *No. 4*, *pp. 305–307*, *figs. 2*).—The vapor pressures of saturated solutions of salts used as fertilizers were determined at various points from 10 to 50° C., and the relative humidities over the solutions were calculated, with the result, among others, that potassium nitrate and phosphate and ammonium phosphate, used in concentrated fertilizers, were found to be among the least hygroscopic of fertilizer salts. In general the hygroscopicity of mixtures of such salts was found greater but in some cases less than that of the most hygroscopic component of the mixture. The value of such determination for the prediction of the storage and handling qualities of mixtures of fertilizer salts is noted.

Are field fertilizer tests of value when analyses according to the methods of Mitscherlich or of Neubauer have been made? [trans. title], **M. Noack** (*Fortschr. Landw.*, *4* (*1929*), *No. 7*, *pp. 200–204*).—Discussing this question a considerable length with reference to a number of tests, the author reaches the conclusion, among others, that the 1-year field-fertilizer test does not give an unconditionally accurate index of the root soluble nutrients in the soil, an

that a field test is in fact so far subject to error that it does not furnish a dependable standard by which to judge such physiological methods for the determination of plant nutrients as those of Mitscherlich and of Neubauer (E. S. R., 53, p. 319). In view of a rather high percentage of results considered successful when obtained by the Neubauer method, and in further consideration of the inherent errors of the field test, the opinion was formed that the field test would best be discarded in further work on potassium and phosphorus fertilization.

The relative efficiency of based and unbased sulfate of ammonia as carriers of nitrogen, A. B. Beaumont (*Massachusetts Sta. Bul. 247 (1929), p. 304*).—Studying the claim that the "basing" of ammonium sulfate, a procedure consisting in the mixing of superphosphate with the ammonium salt and followed by the aging of the mixture in storage, gives a product superior to the untreated ammonium sulfate, the author was able to show conclusively by means of extensive pot experiments that, in so far as concerns any alleged advantage in the plant growth produced, the claim in question is unfounded.

Preparation of potassium nitrate, A. L. Mehring, W. H. Ross, and A. R. Merz (*Indus. and Engin. Chem., 21 (1929), No. 4, pp. 379–382*).—Following historical notes regarding the use of potassium nitrate as a fertilizer and a brief discussion of the advantages of the salt for such a purpose, the authors of this contribution from the U. S. D. A. Bureau of Chemistry and Soils describe a series of experiments upon the conversion, by means either of nitric acid or of nitrogen peroxide, of potassium chloride into the nitrate. The investigation included the trial of three methods for the treatment of potassium chloride with nitric acid, leading to the conclusion that this type of procedure is not commercially practicable on account of the loss of considerable quantities of nitrogen in the form either of nitrosyl chloride or of nitric acid, together with hydrochloric acid, chlorine, and a proportion of water vapor too large to promote the practicable recovery of the nitrogen.

When, however, a 12 per cent mixture of nitrogen peroxide with air, as obtained in the oxidization of synthetic ammonia gas, was passed at room temperature over a potassium chloride solution at such a rate as to bring about the evolution of all the chlorine as hydrochloric acid, a solution containing 20 per cent of potassium nitrate in 45 per cent nitric acid was obtained, and from this solution 90 per cent or more of its potassium content could be recovered as potassium nitrate of a high degree of purity by the cooling of the solution to 10° C. Results so far obtained appear to indicate the possibility of the return of the mother liquor from this crystallization directly to the absorbing system "without appreciable loss of nitrogen in the evolved gas. The process of preparing potassium nitrate from potassium chloride and nitrogen peroxide thus becomes a cyclic one when operated in connection with a plant for the absorption of nitrogen peroxide."

In the process proposed, the nitrogen peroxide mixture with air, obtained by the oxidation of synthetic ammonia, is passed over a potassium chloride solution to form a solution of potassium nitrate in strong nitric acid. This solution is digested under reflux with solid potassium chloride to convert as much as possible of the nitric acid into potassium nitrate, the high-grade potassium nitrate is crystallized by cooling, the mother liquors are returned to the absorbing system, and the chlorine and nitrosyl chloride evolved in the digestion of the strong nitric acid solution with potassium chloride are separated by passing over concentrated sulfuric acid, from which nitrogen peroxide can be recovered for return to the process, and the final products are potassium nitrate, chlorine, and hydrochloric acid.

Cyanamid, its uses as a fertilizer material, F. E. Allison (*U. S. Dept. Agr. Circ. 64 (1929), pp. 12, figs. 8*).—The various steps in the manufacture of cyanamid are concisely outlined. The remainder of the circular is devoted to a discussion of the properties and uses of cyanamid, fertilizer practices in Europe and the United States, the transformations of cyanamid in the soil, the importance of quality, cyanamid in mixed fertilizers, and the use of cyanamid alone.

In conclusion it is stated that in a proportion not exceeding 60 lbs. to the ton of a compatible mixture cyanimid constitutes a satisfactory source of nitrogen and serves also as a conditioner, neutralizing free acids and yielding a product drier and less liable to caking than that obtained without the use of cyanamid.

When used alone fresh material should he nsed unless special precantion has been taken to keep moisture and air from reaching the fertilizer. Cyanamid should not be left in contact with the hands for any length of time; the fertilizer should not be mixed indiscriminately with other fertilizer materials, especially not in any large proportion with superphosphate; heavy applications are to be avoided, and it should not be applied in direct contact with the seed; and, finally, cyanamid should not be used either on poorly drained or on highly acid soils where nitrification is slow.

It is recommended that cyanamid be used alone unless it be known definitely that it is compatible for mixture with the other materials which are to be applied with it; if broadcast for winter grains, grasslands, or orchards, that the application be made before the beginning of spring growth; and if drilled in the row that the application be smaller than the broadcast application; that the land be cultivated to mix the fertilizer thoroughly wih the soil; and that seed be drilled not sooner than a week after the fertilizer treatment.

Cyanamid is considered generally applicable in moderate quantities to soils of good tilth wherever a source of slowly available nitrogen is desirable, provided the fertilizer be thoroughly mixed with the soil a short time before seeding.

Testing fertilizers for Missouri farmers, 1928, L. D. Haigh (*Missouri Sta. Bul. 270 (1929), pp. 51, fig. 1*).—This bulletin consists of the usual annual report of fertilizer analyses and guaranties.

Analyses of commercial fertilizers, season 1928–1929, R. N. Brackett and D. H. Henry (*South Carolina Sta. Bul. 259 (1929), pp. 61*).—This is the usual annual report of analyses and guaranties.

AGRICULTURAL BOTANY

Contributions to the chemistry of the plant cell wall.—II, Lignification in the secondary and tertiary layers of the cell walls of wood, W. M. Harlow (*N. Y. State Col. Forestry, Syracuse Univ., Tech. Pub. 24 (1928), pp. 12, pls. 5*).—The paper previously noted (E. S. R., 60, p. 123), mainly reviewing certain evidences regarding the middle lamella, is now followed up with an account of experimentation dealing explicitly with the remaining layers of the woody cell, and with the microchemical aspects of certain color reactions used in the determination of lignin.

Acids in plant cell membranes, K. Meinel (*Über das Vorkommen von Säuren in der Pflanzlichen Zellmembran. Inaug. Diss., Ludwig-Maximilians-Univ., Munich, 1927, pp. 27, figs. 4*).—This is a University of Munich doctor's thesis.

Seasonal activity of the cambium in some northeastern trees, J. E. Lodewick (*N. Y. State Col. Forestry, Syracuse Univ., Tech. Pub. 23 (1928), pp. 87, figs. 36*).—This is a thesis offered in the New York State College of Forestry.

Methods of obtaining tracheal sap from woody plants, J. P. Bennett, F. G. Anderssen, and Y. Milad (*New Phytol., 26 (1927), No. 5, pp. 316–323, figs. 3*).—Methods of obtaining sap from woody plants are described which afford a point of attack on many problems, particularly those of nutrition. It is thought that studies of the tracheal sap will throw light on such problems as absorption and utilization of substances from the soil, sap flow, root pressure, transpiration, and translocation of organic and inorganic compounds, at least in woody plants. It is hoped to extend the method to many herbaceous plants.

Studies on the growth of root hairs in solutions: The pH molar-rate relation for Brassica oleracea in calcium sulphate, W. K. Farr (*Natl. Acad. Sci. Proc., 15 (1929), No. 6, pp. 464–470, figs. 2*).—Results of experimentation during the summer of 1928 on the growth rate of root hairs of *B. oleracea* in solutions of $CaSO_4$ tested in concentrations of 0.000448 to 0.0140 M at intervals of 0.5 pH units showed that, while the lowest concentrations used would not support growth, a strength of 0.000540 M produced excellent growth in the alkaline range between pH 8.5 and pH 10.5. More detailed experimentation is required to show the extent to which this growth is influenced by the $Ca(OH)_2$ added to increase the alkalinity.

The first typical trimodal curve was produced when the concentration was raised to 0.000714 M. At this and at any higher concentration there appeared two distinct alkaline maxima and one acid maximum, showing close correspondence in the different (three-dimensional graph) models, in their relative positions upon the pH scale. "The pH molar rate relation of root hair elongation becomes clearer when interpreted in terms of a three-dimensional graph."

Compared with the elongation rates of root hairs in calcium nitrate and calcium chloride these results in calcium sulfate are notable for the high growth rate in solutions of low salt concentrations. "The delicacy and the consistency with which these root hairs have responded to the definite concentrations of these simple nutrient solutions, and the ease with which accurate measurements of their elongation may be made, contribute greatly to their value as experimental material for study of this important phase of the growth process, cell enlargement."

Assimilation and transpiration in Kachetien grape varieties [trans. title], W. G. Alexandrov (*Ber. Deut. Bot. Gesell., 46 (1928), No. 2, pp. 126–135*).—Tabular comparisons are exhibited as regards the work of assimilation and transpiration in leaves chiefly of the grape varieties Saperavi, Rkaziteli, and Mzwane in the District of Kachetien, Georgia, Union of Socialistic Soviet Republics.

Studies in the respiration of tropical plants.—I, Seasonal variations in aerobic and anaerobic respiration in the leaves of Artocarpus integrifolia, R. S. Inamdar and B. N. Singh (*Jour. Indian Bot. Soc., 6 (1927), No. 3–4, pp. 133–212, figs. 12*).—In these investigations, which were applied mainly to the seasonal rate variations in aerobic and in anaerobic respiration in starved or unstarved leaves of *A. integrifolia* at Benares, it was found that, unlike the case in temperate regions, the minimum of respiration intensity was obtained in this tropical area in the summer season, the intensity increasing as winter approached and reaching its maximum in the winter leaves. Also, the hourly march of respiration varied greatly for successive seasons, the summer leaves maintaining a level course until the range of injurious temperatures was reached, and the winter leaves showing a progressive decrease in time even under lower temperatures not necessarily entailing leaf injury.

The adaptational nature of these phenomena as noted in connection with temperature conditions prevailing in different seasons is discussed. Evidence indicates a correlation of seasonal changes between the course and intensity

of respiration and the relative availability of active carbohydrates for respiration. It is thought that there occurs a modification of the respiring protoplasm as a response to variation in temperature conditions. In a mature organ of a perennial plant, no relation appears between respiratory intensity and protoplasmic changes inducing growth activity. The capacity of the leaves to withstand without injury high temperature changes with the season. The seasonal variations which occur in leaf respiration appear to be brought about by mutually coordinated self-regulatory mechanisms within the plant. Anaerobiosis and keeping the leaves in the dark for starvation for some time before the experiment affect the hourly march of respiration by decreasing the depressing time-effect. It is suggested that this might be due to the accumulation of injurious products in the leaves. Owing to this disturbing effect, the anaerobic : aerobic ratio becomes altered considerably when the time-effects set in.

The effects of anaerobiosis and starvation indicate that the depressing time-effect in the hourly march of respiration must be a complex phenomenon.

The light growth reactions in Avena [trans. title], C. VAN DILLEWIJN (*Rec. Trav. Bot. Néerland., 24 (1927), No. 1-3, pp. 307-581, figs. 31*).—The extensive data from this study are given by sections in detail with elaborate summary.

Diurnal variations in growth [trans. title], C. COSTER (*Rec. Trav. Bot. Néerland., 24 (1927), No. 1-3, pp. 257-306, figs. 19*).—The longitudinal growth of a plant is a highly complicated phenomenon dependent upon internal and external conditions, as is shown by studies of the elongation of different parts of 19 species growing under natural conditions. Most plants on hot days grew more slowly than during the nights, but these differences were decreased or absent on rainy days. In another group, the plants grew distinctly faster during the day than at night. In a third group, the plants showed a check in growth at night and another in the hot part of the day, with an increase in growth rate both morning and evening. In a fourth group, almost equal rates of growth prevailed throughout the day and night.

Studies of elements required in only small quantities for the development of the green plant [and] miscellaneous investigations, J. A. HARRIS (In *Activities of the Department of Botany, University of Minnesota, 1927. Minneapolis, 1928, pp. 32-40, figs. 2*).—This account of recent studies accredited chiefly to Sommer, following up that previously noted which was carried out with Lipman (E. S. R., 61, p. 23), emphasizes the necessity for refinement of materials and of methods in research dealing with the question of whether certain substances, formerly ranked as unessential to plant growth, should not now be regarded as essential in at least very small proportions.

The effects on the cells and tissues of the absence of boron are somewhat uniformly alike in the presence or absence of each of the other elements studied (magnesium, sulfur, manganese, potassium, nitrogen, iron, phosphorus, and calcium) except in the case of calcium. The effects of the absence of calcium from a standard culture medium have been studied, and this report states that plants of *Pisum sativum* grown without calcium usually die within two or three weeks, and that these show a degeneration in the protoplasts of the meristematic cells of the root tips.

So far as the influence of aluminum on the growth of Chlorella has been studied by Sommer, the aluminum ion appears to be nontoxic in concentrations as high as 25,000 parts per million.

Studies applying primarily to problems dealing with the genetics and physiology of Gossypium "indicate that by a proper combination of agronomic,

physicochemical, and biometric technics it will be possible to carry out field many physiological investigations assumed heretofore to be capa elucidation only under the controlled conditions of the laboratory."

Toxicity, additive effects, and antagonism of salt solutions as ind by growth of wheat roots, W. S. EISENMENGER (*Bul. Torrey Bot. Cl (1928), No. 6, pp. 261–304, figs. 4*).—An account, with details as to resul conclusions, is given of a study regarding the elongation rate of wheat supplied with simple solutions of potassium dihydrogen phosphate, c nitrate, and magnesium sulfate, and with solutions containing pairs of salts.

The relation of oxygen to the germination of the chlamydospo Ustilago zeae (Beck.) Unger.—A preliminary report, G. A. PLATZ *State Col. Jour. Sci., 2 (1928), No. 2, pp. 137–144, fig. 1*).—It is stated th chlamydospores of *U. zeae* do not germinate in the absence of oxygen, an this element must be present to the extent of at least 5 per cent in or secure germination percentages comparable to those obtained in the op During suspension in water, tomato juice, or gelatin in air-tight vials, the made no germination, supposedly owing to lack of oxygen. Deficient ge tion of the spores after dusting upon solutions of liquid media is apparent to the partial deprivation of oxygen.

Relationships between amide and lipoid [trans. title], L. BUSCALIO F. BRUNO (*Malpighia, 31 (1928), No. 1–6, pp. 150–321, pls. 4*).—Method details of research, with numerous conclusions, are given for these stud the relations between amide and lipoid in connection with chlorophyll the developmental stages throughout two or three seasons for a consid number of plant genera and species.

The behaviour of the cyanogenetic glucosides of cherry laurel d starvation, H. GODWIN and L. R. BISHOP (*New Phytol., 26 (1927), No. 295–315, figs. 15*).—An account is given, with the methods employed, of a taneous study of the respiration, yellowing, and cyanogenetic glucoside c of cut cherry-laurel leaves starved in the dark, from which study it is con that during starvation cyanogenetic glucoside disappears. The autho tinguish a slow loss in the green parts and a rapid loss, becoming total, c lowing. The period of maximum loss of HCN is said to coincide fairly as regards time of initiation, duration, and intensity, with similar maxi the rates of yellowing and respiration. The initial HCN contents of the of different ages are about the same. The younger the leaves the smaller rate of glucoside loss before yellowing and the longer is the time of comm ment of the rapid loss postponed. These phenomena are correlated in a g hypothesis of protoplasmic behavior.

Physiological studies of Cuscuta monogyna [trans. title], M. LILIEN (*Ber. Deut. Bot. Gesell., 46 (1928), No. 1, pp. 18–26*).—Studies are indica applied to *C. monogyna*, giving details regarding the acidity of various also facts regarding chlorophyll and the activity of peroxidase and diast Cuscuta, which appears to be characterized by a very complicated metab

Sexuality in fungi [trans. title], W. H. SCHOPFER (*Bul. Soc. Bot. G 2. ser., 20 (1928), No. 1, pp. 149–323, figs. 37*).—An account in copious t systematic detail, with a bibliography of nearly 300 titles, is given of the and literature on the comparative biochemistry of sexuality in fungi.

Histological studies on the Exobasidiaceae [trans. title], P. EFTIMI S. KHARBUSH (*Rev. Path. Vég. et Ent. Agr., 14 (1927), No. 1, pp. 62–88, figs. 9*).—As one result of this work the authors detail certain morphol histological, and microchemical phenomena as found and followed in the basidiaceae studied in connection with their hosts.

Symbiosis and asymbiosis relative to orchids, L. KNUDSON (*New Phytol., 26 (1927), No. 5, pp. 328–336*).—This is chiefly argumentative, dealing with accounts somewhat at variance with claims set forth in the present author's papers, previously noted (E. S. R., 56, p. 24).

Mycorrhiza of southern pines, L. J. PESSIN (*Ecology, 9 (1928), No. 1, pp. 28–33, pl. 1*).—Observations in the nursery of the Southern Forest Experiment Station at Bogalusa, La., in December, 1926, of pine seedling roots possessing numerous mycorrhiza having led to a study of mycorrhiza in field and laboratory, the author reports that mycorrhiza were found abundantly on the roots of seedlings of *Pinus echinata*, *P. palustris*, *P. taeda*, and *P. caribaea*. The mycorrhiza, occurring chiefly on lateral branches of the roots in the upper soil layers, are produced by Hymenomycetes. The abundance and distribution of the growths, considered in connection with the apparent vigor of the seedlings, suggest that the fungus is not a parasite but a beneficial symbiont.

The bacteriophage of d'Herelle [trans. title], P. HAUDUROY (*Rev. Path. Vég. et Ent. Agr., 14 (1927), No. 4, pp. 272–302*).—A condensed account, dealing with many phases of the subject, is given of the bacteriolytic agent designated as bacteriophage by d'Herelle, its discoverer, whose treatise on that subject has been noted (E. S. R., 57, p. 769).

Key for yeasts, A. GUILLIERMOND (*Clef Dichotomique pour la Détermination des Levures. Paris: Libr. Le François, 1928, pp. 124, figs. 65*).—The several sections of this booklet present the general characters of yeasts, methods of culture and observations, isolation, method of determination, and a key.

A recording atmometer, J. D. SAYRE (*Ecology, 9 (1928), No. 2, pp. 123–125, figs. 2*).—A simple, continuously acting, automatically recording atmometer is described as adaptable to different conditions and as capacitated to run continuously for a week.

GENETICS

Physiological evidences of evolution and animal relationship, C. G. ROGERS (*Sci. Mo., 27 (1928), No. 6, pp. 506–521, fig. 1*).—Evidence of evolution and relationship in different species is presented as selected from the field of animal physiology. The evidence offered is based on the composition, osmotic pressure, and hydrogen-ion concentration of the body fluids in comparison with that of sea water; blood pigments and blood reactions; chemical action in living matter and similarity of hormones in different species; excretion and reproduction; and the potential immortality of tissues when isolated in tissue cultures and provided with appropriate food and means of disposing of waste products.

Detection of heterozygotes with X-rays, R. T. HANCE (*Jour. Heredity, 19 (1928), No. 11, pp. 481–485, pl. 1, figs. 2*).—Homozygous and heterozygons agouti mice were treated at the University of Pittsburgh at the age of 10 to 14 days with a sufficient dose of X-ray to cause the hair to shed. The hair developing afterward on heterozygous animals contained from 3 to 4 white hairs to 1 agouti hair, giving a grayish appearance, while only a few white hairs appeared in the second coat in homozygous agoutis. A stronger dose produces a larger percentage of white hairs in homozygous individuals.

In explanation of the results, it is suggested that the X-rays inhibit the power of the cells to produce tyrosinase, but that their power to resist the inhibiting action of the X-rays is greater in the presence of two genes for color than in the presence of one color factor.

Hereditary constitution and X-rays, R. T. HANCE (*Sci. Mo., 27 (1928), No. 3, pp. 264–266*).—Another account of the results of experiments dealing with the difference in response of heterozygous and homozygous mice to X-rays, as noted above.

The production of mutations by X-rays, H. J. MULLER (*Natl. Acad. Sci. Proc., 14 (1928), No. 9, pp. 714–726*).—On the basis of the results of the effect of X-rays in inducing mutations in Drosophila noted (E. S. R., 58, p. 25) and further studies, as well as investigations of others along similar lines, the author discusses the probable nature of the gene and gene transmutations.

It is pointed out that the results support the hypothesis of the linear arrangement of the genes in the chromosome and the mechanical theory of crossing over. A gene is thought to consist of a single protein molecule. The mutations produced by X-rays are considered to result at a certain point because of an accidental concentration of rays at that point. The small amount of evidence in support of the reversibility of the mutations resulting from X-ray irradiation tends to indicate that mutations may result from a loss, but the case of dominant eyeless is cited as well as some other evidence to show that there is not necessarily a loss in case of induced mutations. Chromosome breakage and translocation of a part so influence the developing zygote and prevent the occurrence of certain phenomena in the region that it is suggested as a cause for isolation and is perhaps a possible factor in divergent evolution. It is suggested that all mutations may be associated with the concentration of rays of the short wave lengths and with high speed particles of corresponding energy content, though the evidence is not yet complete and it will be very hard to prove because of normal low mutation rate and the difficulty of excluding all radiation.

The inheritance of left-handedness, H. D. CHAMBERLAIN (*Jour. Heredity, 19 (1928), No. 12, pp. 557–559*).—A study of the handedness of 2,177 freshmen at Ohio State University, together with their parents and sisters and brothers, and data on other families indicated quite conclusively the heritability of left-handedness. In the entire group there were 4.34 per cent left-handed individuals. Among children of parents both of which were left-handed, there were 46 per cent left-handed. There were only 2.1 per cent of left-handed children among those having both right-handed parents.

A claw-fingered family, L. S. CLEMENTE (*Jour. Heredity, 19 (1928), No. 12, pp. 529–536, pl. 1, figs. 5*).—The occurrence of an abnormal thickening of the nails of the fingers and toes of a man and of five of his nine children is described. As this condition was not observed in his parents, grandparents, or uncles, it is assumed to be a dominant mutation.

The tricolored condition in cattle [trans. title], E. LAUPRECHT (*Züchtungskunde, 3 (1928), No. 11, pp. 557–563, pl. 1, figs. 2*).—The author describes two cases of tricolored cows and discusses the possibility of the factor for black and red [tortoise] in cattle being a third allelomorph in the red series, as in rodents.

The inheritance of a ticking factor in hounds, L. F. WHITNEY (*Jour. Heredity, 19 (1928), No. 11, pp. 498–502, figs. 5*).—From a study of breeding records the author reports that roaning on a white body color in dogs, a characteristic designated as ticking, is due to a single dominant Mendelian factor.

A cross-over between the genes for short-ear and density in the house mouse, G. D. SNELL (*Natl. Acad. Sci. Proc., 14 (1928), No. 12, pp. 926–928*).—Among 579 F_2 individuals produced from the cross of normal-eared dilute by short-eared dense mice at the Bussey Institution, 1 crossover female of the constitution S^es^edd was found as a result of progeny tests. A considerable stock of double recessives has now been obtained from this female for use in testing the linkage relationships between short-ear and density.

Pigment inheritance in the Mexican killifish, M. GORDON (*Jour. Heredity, 19 (1928), No. 12, pp. 551–556, figs. 5*).—The author reports the results of a

study of the interaction between stippling and spotting, each due to dominant factors and the latter being sex-linked. It appears that, while the spotting factor partially inhibits stippling, about 30 per cent, the stippling factor enhances spotting about 70 per cent.

The genetics of the domestic fowl (*Jour. Heredity, 19 (1928), No. 11, pp. 511–519*).—This abstract, by L. C. Dunn from the translation by B. F. Glessing, summarizes the behavior of the 17 color factors in fowls as reported by Koltzoff (E. S. R., 58, p. 29) from the Anikowo Genetical Station, Russia.

Studies on the inheritance of egg-weight.—II, The effect of selection on egg-weight, compiled and edited by N. F. Waters and J. C. Weldin (*Rhode Island Sta. Bul. 218 (1929), pp. 26, figs. 2*).—This bulletin deals with a study of the weights of the eggs produced by the White Plymouth Rock flock of which a statistical study was previously noted (E. S. R., 43, pp. 674).

Birds were classified phenotypically as large-egg producers when the weight averaged more than 56 gm., and as small-egg producers when the average egg weight was less than 56 gm. During the first two years there was no selection for egg size, but from 1912 to 1920 selection was made for large-egg and small-egg strains, which were also crossed.

The results indicated that the genetics of egg size was controlled by a single Mendelian factor, but there were undoubtedly many environmental and probably genetic modifiers. The points in support of this hypothesis are given as: (1) Matings of hens laying small eggs with roosters whose dams laid small eggs produced only birds laying small eggs for five consecutive generations; (2) matings of producers of large eggs gave progeny laying large and small eggs in a 3:1 ratio; (3) small-egg producers bred true when segregated from matings of large-egg producers; (4) the usual 1:1 ratio among the progeny was observed in the matings of heterozygous with recessive birds; (5) large egg size was dominant to small egg size in homozygous matings; and (6) matings between homozygous large-egg producing birds produced only large-egg producing progeny. Certain objections to the hypothesis are also pointed out, such as the arbitrary adoption of 56 gm. as the division point between large-egg and small-egg producers, progeny producing small eggs continued to come at the rate of about 20 per cent from matings of large-egg producers after six generations of inbreeding, males were selected on the basis of their dams' egg size, and certain of the ratios indicated that more than one factor was operating. Egg size was not sex-linked or sex-limited, but was transmitted equally by both sire and dam.

A case of alopecia in the fowl, C. H. Danforth (*Jour. Heredity, 19 (1928), No. 12, pp. 546–550, figs. 3*).—A purebred Rhode Island Red, which was very sparsely feathered but in which normal feather development in a White Leghorn skin graft occurred, is described from Stanford University. It is concluded that the deficiency in feather development was not due to a lack of endocrine secretions.

The control of fertility in animals [trans. title], J. Hammond (*Züchtungskunde, 3 (1928), No. 11, pp. 523–547, figs. 3*).—A brief summary of the factors affecting fertility in animals, including a discussion of the breeding season, number of ova maturing, fertilization, and fetal atrophy.

The hydrogen-ion concentration of horse semen and the optimum for vitality of the spermatozoa of the horse and rabbit [trans. title], J. Yamane and K. Kato (*Ztschr. Tierzüchtung u. Züchtungsbiol., 12 (1928), No. 3, pp. 347–364, figs. 2*).—The pH of 26 samples of normal horse semen from 7 stallions was found to vary from 7.26 to 7.67, as determined by the electrometric method, and from 7.3 to 7.7 by the colorimetric method. It is pointed out that

this reaction is more nearly normal than has been reported by others, which is explained as due to the fact that the semen collections were made without contamination by the vaginal secretions. Attention was called to the similarity between the properties of the blood and semen, but in a comparative test it was found that the buffer properties of the latter were relatively weak.

In studying the influence of the pH on the duration of vitality of the sperms, tests were conducted with samples from 3 stallions which were modified by a dextrose phosphate solution, so that the pH ranged from 6.5 to 8.0. The duration of motility was the shortest (about 10 hours) in the samples having a pH of 6.5. In semen of the optimum pH 7.2 to 7.4 some motility was observed for about 100 hours, which was approximately 10 times longer than that observed in the pure semen. The optimum pH for the duration of motility was also 7.2 to 7.4 in rabbit semen, and the effects of differences in the pH concentration were very similar to those observed in the horse semen.

The influences which cause variation in the duration of the gestation period of mares [trans. title], F. Bílek (*Sborn. Výzkumn. Úst. Zeměděl. Repub. Československ. (Rec. Trav. Insts. Recherches Agron. Répub. Tchécoslov.), No. 33 (1927), pp. 43, figs. 7; Ger., Fr., Eng. abs., pp. 34–42*).—The variation in the gestation periods of mares of different breeding has been studied, from which it was found that the gestation period was shorter in draft mares than in mares of lighter breeding. It was also shown that individuals were rather constant in the length of the gestation period in successive parities. Daughters resembled their dams as regards the length of the gestation period. Other conditions were found to affect the duration of gestation, as follows: The periods were shorter in colored mares, shorter when the sires were young stallions, and longer when the sex of the fetus was male. No correlation was observed between the age of the mare or the parity and the length of the gestation period. Older mares were more likely to have horse foals than younger mares.

Observations of sex-ratio determination in Sciara (Diptera), C. W. Metz and M. S. Moses (*Natl. Acad. Sci. Proc., 14 (1928), No. 12, pp. 930–932, fig. 1*).—Studies at the Carnegie Institution of the sex of the progeny of 23 females of *S. coprophila* and 16 females of *S. impatiens*, both species being of the unisexual-producing strains, indicated that both male and female producers were present in the progeny of each female in approximately equal numbers. The hypothesis suggested by way of explanation is based on the assumption that female-producing females are heterozygous (*Aa*), while males and male-producing females are homozygous recessive (*aa*). The constitution of the exceptional individuals observed was tested. A few males were of the ordinary *aa* type, and 22 exceptional females were all of the *aa* type. It appears that changes from the unisexual to the bisexual type of production probably involve gene mutation.

Evidence that the female is responsible for the sex ratio in Sciara (Diptera), M. S. Moses and C. W. Metz (*Natl. Acad. Sci. Proc., 14 (1928), No. 12, pp. 928–930*).—In matings of one male with several females and one female with several males, it was found at the Carnegie Institution that in those strains of Sciara which typically give unisexual progeny the female controls the sex. It was further found that the sperms of the first male that a female mates with fertilize all the eggs laid by her.

FIELD CROPS

[Agronomic work in Idaho in 1928] (*Idaho Sta. Bul. 164 (1929), pp. 16–19, 41–43*).—Mosida and Triplet winter wheat, Jenkin, Federation, and Red Bobs

and Kaiser and White Canada for hogging off or in grain-pea mixtures for hay were among the better yielding varieties (E. S. R., 59, p. 728). Trials of varieties of these crops and corn, alfalfa, grasses, and potatoes are also reported on from the Sandpoint Substation. Sherman, a new wheat outstanding for dry farm areas in southeastern Idaho, yields well, is quite smut resistant, and surpasses the usual Turkey in protein.

Satisfactory seed yields of alfalfa in the Palouse region again depended on thin stands, not more than 1 plant per square foot, and the use of first growth. Early seeding of from 8 to 10 lbs. per acre and without a nurse crop is indicated for alfalfa. However, early varieties of peas were more desirable for nurse crops than any small grain. Gypsum and sulfur were equally satisfactory on legumes at Winchester, the results indicating that 200 lbs. of gypsum should be added to alfalfa every three or four years. Sulfur and lime did not increase yield over sulfur alone, and lime alone did not excel the untreated check plats.

The chlorates have been most satisfactory in weed eradication, controlling effectively all weeds with running rootstocks. Carbon disulfide is effective for small areas when the soil moisture content can be controlled.

In cultural experiments with wheat at the High Altitude Substation from 3 to 5 bu. more per acre has been obtained by from two to four extra harrowings, depending on the time of harrowing and date of plowing. The harrow should follow the plow before the soil has time to dry out. Use of the disk in working the ground before plowing has resulted in increased yields of grain, seeming to conserve soil moisture and facilitate plowing. Seed treatment decidedly reduced the percentage of smut. Sweetclovers have given good results in rotation, as green manures and pasture, and have made good dry-farm hay.

Trials at the Sandpoint Substation indicate August seedings for fall wheat, mid-early planting for spring wheat, and early spring sowing for field peas at the rate of 150 lbs. per acre. Hill selection of potatoes proved better than bin selection or other bulk methods of obtaining seed. Late May and early June plantings returned the best potato yields. Hot formaldehyde treatment has given better control of tuber diseases than cold formaldehyde or bichloride of mercury and also has given larger yields of potatoes.

Crop production (*Maryland Sta. Rpt. 1928, pp. XI, XII*).—Varietal trials have shown the superiority of Culberson, Custis, Turf, and Lee oats; red clover from Maryland, Ohio, and Tennessee; and Virginia and Wilson soybeans. The behavior of several forage legumes is noted briefly. Increase in rate of liming was followed by a heavier growth of Kentucky bluegrass and a smaller percentage of weeds.

[**Crop production studies in Massachusetts**], A. B. Beaumont, J. P. Jones, and L. S. Dickinson (*Massachusetts Sta. Bul. 247 (1929), pp. 303, 304, 326*).—Among significant observations in a study of cropping systems were the failure of tobacco in rotation with corn and hay, the lack of positive benefit from the use of timothy, rye, or redtop as cover crops for tobacco, and the obtaining of the best yield and quality with tobacco growing every year on the same land. Of preceding crops, corn and hay have been most detrimental on yield and quality of tobacco and potatoes and onions the least. Tobacco after tobacco usually has been better than after potatoes and equal to that after onions. Data from tobacco farms supported station findings on soil management and cropping systems. For example, it was found that continuous tobacco grown outyielded tobacco in rotation, that cover crops were slightly detrimental, and that lime and ashes reduced yields.

Fertilizer trials have given indications that, on land producing poor tobacco, although well fertilized, rather heavy applications of superphosphate will improve the yield and quality of tobacco. From 150 to 200 lbs. of nitrogen per acre

seemed necessary for satisfactory growth. Among many inorganic and organic forms, the nitrate form of nitrogen appeared to be the most readily assimilated by and to produce the best quality of Havana tobacco. The nitrate form of nitrogen evidently tends to counteract the so-called brown root rot of Havana tobacco. Ammonium compounds in low concentrations are said to cause a poor root development often accompanied by symptoms similar to brown root rot. Results under some conditions have indicated aluminum to be severely toxic and less under others.

The character of pasture vegetation has been changed by top-dressings of line, superphosphate, and potassium chloride. A weedy growth largely of cinquefoil and moss has been replaced with white clover, bluegrass, and redtop. Fertilizers also brought about complete changes in lawn grasses, but during the change crab grass was prominent on both acid and alkaline plats, although not observed where clover was plentiful. Many kinds of weeds were noted on alkaline plats and few on the acid. After four years of a test to determine the value of adding phosphorus and potassium to nitrogenous fertilizers, potassium did not seem desirable on rather heavy soil. Bents did best when receiving acid nitrogen with phosphoric acid, fescues thrived on the plats receiving acid nitrogen alone, and weed competition was too great for bluegrasses in plats receiving alkaline nitrogen with phosphoric acid and potassium.

[Field crops work in Nebraska, 1928] (*Nebraska Sta. Rpt. [1928], pp. 13–16, 26, 27, 31–33, 41, 42, 43*).—The trend of improvement work and varietal and cultural tests with corn, wheat, oats, and barley, variety trials with alfalfa, crop rotations, and soil fertility studies is reported on from the station and substations as heretofore (E. S. R., 59, p. 824).

Treatment of seed corn with organic mercury compounds did not affect materially stand or yield of typical farm-selected seed, although seed chosen for heavy infection with Diplodia dry-rot disease responded with improvement in these respects. It was observed that much more reliable yield determinations may be made through the use of multiple rather than single row plats whenever materially dissimilar varieties or hybrids are being compared. With winter wheat both copper carbonate and formaldehyde were found effective in smut control. Notable among varieties were Nebraska 60 winter wheat, Garnet and Ceres spring wheat, Nebraska 21 and Burt 293 oats, and Comfort and Glabron barley.

Milling and baking tests on the 1927 crop of Nebraska wheat showed that the standard hard winter wheat varieties in Nebraska equal similar varieties from other localities when compared on an equal protein basis. Certain consistent differences were established definitely between flours milled on an experimental mill from small lots of wheat and flours milled commercially from the same but vastly larger lots of wheat. The commercially milled and treated flours are higher in diastatic power, which manifests itself in their greater ability to sustain yeast fermentation, and frequently have their gluten characteristics more or less altered by certain oxidizing agents used for bleaching.

In station tests straw mulching did not influence healthy seed potatoes significantly nor were "run-out" lots due to spindle tuber rejuvenated by growth under a straw mulch. Spindle tuber spread to a much greater extent in the lower than in the upper parts of a field. Biweekly plantings, commencing early in October, of cut sets treated with ethylene chlorohydrin responded to the treatments as late as February 16, the riper lots showing the greatest response. A study of variations between the individuals of a variety gave indications that many variations are due to strain differences and that strains may be selected to meet special purposes. The type in normal disease-free tubers generally

considered ideal seems to be produced most readily under conditions of low temperature, low moisture, light soils, and late planting. Indications are that in tuber indexed stock of Triumph potatoes mosaic has been almost entirely eliminated by this system, and that spindle tuber and other diseases have been reduced to a low minimum.

The drouth of 1926–7 in relation to soil moisture and crop yields at Goodwell, Okla., H. H. Finnell (*[Oklahoma] Panhandle Sta., Panhandle Bul. 8 (1929), pp. 9–23, figs. 6*).—The most severe drought during the years 1911 to 1928 at Goodwell covered the period from October, 1926, to May, 1927, during which the average monthly rainfall was 0.37 in. and resulted in complete failure of small grains. In the preceding year high yields were obtained from all types of crops. The performance of 14 crop rotations on silty clay loam soil for these 2 years of extreme conditions is presented.

The ability of the soil type to retain a large supply of moisture through protracted droughts was demonstrated. On land containing much available moisture deep tillage during the drought materially reduced the quantity present when the drought ended. The cropping previous to the drought affected the quantity of soil moisture present and carried through the dry period. Listed in the order of the quantity of soil moisture present in May, 1927, the cultures were summer fallow, cowpeas, corn, wide-spaced sorghum, close-spaced sorghum, small grains, sweetclover, and alfalfa. Cropping plans which maintained a soil moisture reserve through the drought of 1926-27 also carried through a good supply of nitrates. The highest average yields during 1927 came from rotations passing through the drought with moisture and fertility reserves and from rotations including large areas of adapted summer crops.

***Observations on agriculture: Fifteen years of agronomic investigation* in Uruguay**, A. Boerger (*Observaciones sobre Agricultura: Quince Años de Trabajos Fitotécnicos en el Uruguay. Montevideo: Impr. Nac., 1928, pp. 580, pls. 68*).—This is a rather comprehensive report of agronomic and plant breeding investigations carried on largely at the National Institute of Phytotechnology and Seed Station of La Estanzuela (E. S. R., 44, p. 526). Successive accounts deal with the history and status of the enterprise, environmental conditions, soils, rainfall, technic, seeding practice, rotations, fertilizers, forage, alfalfa, potatoes, and good seed. Genetic and plant breeding work with wheat, corn, flax, oats, barley, and other crops is reviewed in considerable detail.

The persistence of certain lawn grasses as affected by fertilization and competition, E. S. Garner and S. C. Damon (*Rhode Island Sta. Bul. 217 (1929), pp. 22*).—Continued fertilizer trials with lawn grasses (E. S. R., 37, p. 446) are described for the period 1917–1928. In 1917, and later, many of the original plats were taken up and reseeded with different grasses, while the original fertilizer treatment was modified on others, although none of the existing plats was ever weeded.

Critical examination of data recorded showed that the fertilizers were effective in producing healthy turf and a wide range in H-ion concentration. The bent grasses seemed to be particularly tolerant to acid soil reaction. Under either acid or alkaline conditions red fescue and fine-leaved fescue were very durable, whereas redtop and crested dog's-tail were short-lived. Kentucky bluegrass did not persist so well as acclimated bent grasses, especially with relatively high soil acidity. White clover volunteered most freely in slightly acid soil. Weeds were fewer as the acidity increased.

The morphological nature of teopod corn, P. Weatherwax (*Jour. Heredity, 20 (1929), No. 7, pp. 325–330, figs. 4*).—The characteristics of teopod corn (E. S. R., 53, p. 29), particularly the floral organs, are described in some detail.

Varieties of cotton for the Blackland region of central Texas, D. T. KILLOUGH, H. DUNLAVY, and H. E. REA (*Texas Sta. Bul. 399 (1929), pp. 47*).—Variety tests with cotton varieties at the Temple Substation during the period 1912 to 1927 showed Kasch to be the highest yielder, followed by Qualla, New Boykin, and Harper. These four varieties have somewhat similar characteristics, representative of the Mebane Triumph type of cotton, produce lint from ⅞ to 1 in. long, have medium- to large-sized bolls, and are high in lint percentage, ranging from 37 to 40, and are relatively early in maturing. During the 3 years 1925 to 1927 the comparative value of the lint per acre was for Kasch $45.36, Qualla $43.88, New Boykin $42.32, Harper $42.23, Acala $41.60, Anton $40.88, Mebane $40.36, Sunshine $39.36, Truitt $39.24, Lankart $39.05, and Lone Star $37.92.

The results are thought to be probably applicable to the greater part of the Blackland Prairie region of Texas.

Varietal and seasonal variation of "motes" in upland cotton, H. E. REA (*Jour. Amer. Soc. Agron., 21 (1929), No. 4, pp. 481–486*).—In a second study (E. S. R., 60, p. 328), the percentage of motes was determined for 16 commercial varieties of cotton grown at the Temple, Tex., Substation in 1925 and 1926. Of 1,323 plants examined, only 2 lacked motes.

The percentage of motes ranged from 14.7 per cent for Sunshine in 1926 to 47.4 per cent for Durango in 1925. Durango showed the highest percentage of motes and Anton the lowest in 1925, and Snowflake was highest and Sunshine lowest in 1926. Distinct differences were found to exist between varieties in mote production, regardless of season, Durango being significantly higher than most other varieties for both years. Acala, Snowflake, and Durango exhibited a marked contrast to Belton, Kasch, and Harper in this respect.

Seasonal conditions seemed to account for a wide variation in the percentage of motes produced. The year 1925 was much drier than the year 1926. Seventy-five per cent of the varieties studied showed significantly higher percentages of motes in 1925 than in 1926.

Methods of selfing cotton flowers (*Empire Cotton Growing Rev., 6 (1929), No. 1, pp. 44–49, fig. 1*).—The methods outlined for self-fertilization of cotton flowers include tying the buds, wiring, stitching, and bagging or netting.

Hairy bolls and nectaries in a hybrid cotton, R. H. PEEBLES (*Jour. Heredity, 20 (1929), No. 7, pp. 340–347, figs. 7*).—Pronounced pubescence observed in a progeny of Pima × College cotton is described and comment made on the occurrence of intracarpellary hairs in different cottons. Examination of intracarpellary hairs in Pima×Acala F_2 progenies showed hairiness dominant, with indications of two factors involved.

The operation of the seed control law upon the pedigree of cotton seed in seasons 1926–27 and 1927–28, W. L. BALLS and ARMENAG EFF. BEDEVIAN (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 85 (1929), pp. [1]+61, pls. 27*).—The first two years' operation of a seed control law promulgated in 1926 is reviewed, with observations on its effects.

[Experimental work on cotton, 1925, 1926, and 1927] (*Egypt Min. Agr., Cotton Research Bd. Rpt., 6 (1925–1927), pp. 1–69, 85–100, pls. 36*).—Investigations with cotton in Egypt under the Cotton Research Board during the years indicated were similar in scope to and in many cases continued experiments recorded earlier (E. S. R., 60, p. 224). Fertilizer and rotation experiments are also included.

Contribution to the study of the hemp stem [trans. title], A. P. D'ÎAKONOV (*Nauch. Agron. Zhur. (Jour. Landw. Wiss.), 4 (1927), No. 1, pp. 34–47, figs. 13*).—In a morphological and microscopic investigation of female hemp stems,

the plants were grouped according to length, as follows: Up to 100 cm., 100 to 125, 125 to 150, 150 to 175, 175 to 200, and longer than 200 cm.

Within each group the internodes varied in number. In plants from 79 to 218 cm. in length the number of internodes varied from 8 to 10. The length of the internodes from the base to the top of the plant increases at first, then decreases, the maximum length being found in the second or third internode. In its cross section the form of the stem changes from an irregular round shape below to a more rounded shape at the top. The diameter at the base of the internodes decreases toward the top. In general the longer stems were found to have the larger average diameters.

The microscopic study revealed in the fibrous layer of the hemp that the elementary fibers nearer the periphery have larger diameters than those closer to the center, especially at the lower portion of the stem of the plant where there are more fibers with a small diameter. These fibers at the base of the stem combine into groups forming triangular bundles, the top of which is directed toward the periphery of the stem and usually closes up with a group of cells of large diameter. These cells are known as primary and the smaller cells as secondary. The total elementary fibers at various heights of a plant vary, although the change in number of these cells through the length of the stem is fairly regular. In average diameter the primary cells decrease from the base toward the apex of the stem. The number of elementary fibers in plants of various thickness fluctuates within wide limits. Increase in thickness is accompanied by rise in the number of primary cells. The thinnest plants at mid-height have no secondary cells; with increase in diameter such cells rapidly increase in number.

Fiber determinations gave indications that a relation exists between the absolute quantity and percentage content of fiber and the diameter of the stem. The thicker plant contains the more fiber, but coincidently the percentage on the total weight of the stem decreases. The maximum quantity of fiber is found generally at the base of the stem, but often may be found slightly above.

The effect of X-rays on potato tubers for "seed," H. B. Sprague and M. Lenz (*Science, 69 (1929), No. 1797, p. 606*).—Certified seed of Irish Cobbler and Green Mountain potatoes was subjected to 5 and 10 minutes' irradiation (X-ray), with one-half of each tuber untreated as a control, in experiments at the New Jersey Experiment Stations. The 5-minute treatment resulted in slight increases in number of tubers, in marketable size, and in average weight of tubers. While 10-minute treatment reduced the number of tubers formed, the average weight of tubers of marketable stock (over 45 gm.) was considerably greater. Other than an apparently slight injury to the first leaves in the case of the 10-minute treatment, no particular abnormalities were observed.

Sweet sorghums for syrup and forage, C. K. McClelland (*Arkansas Sta. Bul. 241 (1929), pp. 24, figs. 5*).—The relative merits of varieties of sorgo tested during 1921 and 1924–1928, inclusive, are shown in tons of stripped cane, forage production, percentage and quality of juice, and output of sirup per acre and per ton of cane.

Honey, a late sorgo, was outstanding in tonnage of cane per acre, in sirup production, in ease of manufacture, and quality of product. While early varieties were valuable for early sirup and forage, they were lacking in total production and in quality. Yields of stripped cane ranged from about 3 to 24 tons per acre, varying with varieties and with seasons. An average or reasonable production should run above 8 tons per acre. The acre yield of sirup varied from 15 gal. from an early sorgo in a poor sirup year to 238 gal. with a later and better variety in a better season. Average or profitable pro-

duction evidently should exceed 75 gal. per acre, depending more or less on seasonal conditions.

Rainfall in June and August was highly correlated with sirup production per acre. July rainfall was less important and September rainfall unfavorable to high production with Honey sorgo. No relation was apparent between production and monthly temperatures.

The percentages of extracted juice seldom reached 50 per cent of the weight of stripped cane, although the moisture content ran much higher. From 30 to 45 per cent was a good extraction in the studies. The number of pounds of juice required to make 1 lb. of sirup varied from about 4 to 16, averaging about 8 lbs. of juice to 1 of sirup. Gallons of sirup per ton of cane varied from about 3.5 to 14, depending upon the variety and seasonal conditions. The average in the poorest season was 5.5 gal. and in the best 9.9 per ton.

For forage or for soiling or silage, the production was about 11 tons per acre from the lowest yielding sorgo and about 33 tons from the highest. Varietal purity could be maintained and improved by bagging the panicles of choice plants before blooming. Practically no crossing resulted from planting very early sorgos beside the very late varieties.

Illini soybeans, C. M. Woodworth (*Illinois Sta. Bul. 335 (1929), pp. 545–556, figs. 2*).—The Illini soybean, a single plant selection from the A. K. variety, is primarily a seed type, early maturing (105 days), stands well, holds its seed well, and has white flowers, gray pubescence, yellow seeds with light brown hilum or seed scar, and yellow to light brown pods. In yield tests the Illini has given significant increases over the Dunfield and Ebony varieties. In oil content it has compared favorably with other soybeans. Illini seems to be best adapted to central Illinois conditions.

Sugar plants of technical value [trans. title], B. A. Panshin (*Nauch. Zap. [Inst. Sakh. Promysh., Kiev], 8 (1929), No. 2, pp. 41–68, figs. 10; Eng. abs., pp. 66, 67*).—Chicory with from 18 to 19 per cent of sugar in its juice, Jerusalem artichoke 17 to 18 per cent, corn to 14 per cent, sorgo 20 per cent or more, watermelons 10 to 20 per cent, pumpkins 8 to 12 per cent, and melons 17 to 18 per cent in the juice appeared to be sources of sugar to supplement the inadequate sugar production by sugar beets in the Union of Socialistic Soviet Republics.

Methods in investigations with beet seed and criticism on field experiments with beets [trans. title], M. Plaut (*Ztschr. Ver. Deut. Zuckerindus., 79 (1929), Apr., Tech. T., pp. 203–240, figs. [16]*).—The experiments discussed were concerned with the moisture content, purity, cleaning, germination, and genuineness of variety of beet seed, field trials of beet seed, and the sampling of stocks of beet seed and grain.

[Sugarcane production in the Philippines] (*Philippine Sugar Assoc. Ann. Conv., Com. Rpts., 6 (1928), pp. 7–26, 27–46, 53–58, pl. 1, figs. 21*).—Articles of interest to agronomists include [A Report of the Experimental Activities of the Philippine Sugar Association], by H. A. Lee, M. L. Roxas, and L. B. Uichanco (pp. 7–26); Knowledge of the Cane Roots in the Soil and its Application to Tillage and Cultivation Operations (pp. 27–31) and The Value of Stool Counts in Experimental Work (pp. 38, 39), both by G. H. Bissinger; Tillage and Cultivation Practices Which Will Aid in Field Drainage, by G. Villanueva and [H.] A. Lee (pp. 31–36); Rainfall Correlated with Ground Water Level, by R. C. Pitcairn (pp. 36–38); Growth Measurements of Cane and Their Uses in Comparing Cultivation Practices, by [H.] A. Lee and R. C. Pitcairn (pp. 39–44); The Structure of the Sugar-Cane Plant in Relation to Cultivation

:tices, by H. A. Lee and M. G. Medalla (pp. 44–46); and Cane Harvesting Transportation, by C. J. H. Penning, R. C. Pitcairn, et al. (pp. 53–58).

eport of the committee on cane varieties, diseases, and fertilizers for sixth annual convention of the Philippine Sugar Association, 1928, ., Roxas et al. (*Manila: Philippine Sugar Assoc., 1928, pp.* [3]+*128, pls. 4, 8*).—This report comprises a number of articles on varieties and seedlings ugarcane, comparative field tests, selection and breeding work, fertilizer cultural experiments with sugarcane, and insect pests of sugarcane.

he size of seed pieces in relation to germination and the relation of gation to germination, H. A. Lee and P. Quizon (*Sugar News, 10 (1929), 3, pp. 176–185, figs. 3*).—Germination studies with cuttings of Hawaiian cane, reported in both English and Spanish, showed 3-eye pieces irrigated r planting to germinate best (29.4 per cent of all individual eyes), 10-eye ings next, and 2-eye the poorest. The 10-eye, 3-eye, and 2-eye pieces :ed in order as to germination of the whole seed piece with 90, 56, and 32 cent, respectively. Evidently under low soil moisture conditions, severe germination, large cuttings will produce more uniform stands and hence er yields per unit area. Irrigation after planting increased very markedly germination of 2-eye and 3-eye pieces but had very little effect on the 10-cuttings.

ane ripening experiments, J. A. Verret, A. J. Mangelsdorf, and C. G. nox (*Hawaii. Planters' Rec., 33 (1929), No. 2, pp. 210–225, figs. 4; abs. in). Agr. [Trinidad], 6 (1929), No. 8, pp. 232, 233*).—In an experiment made he Honolulu Plantation Co., cooperating with the Hawaii Sugar Station, 10 ormly distributed plats of sugarcane were harvested at the beginning of ding (25 days after final irrigation), a second 10 plats 3 weeks later, and n, until in all 7 series covering 4 months were harvested. Milling and iical studies were made on the material harvested.

ie yield of sugarcane per acre increased sligbtly up to 44 days and remained tically constant thereafter. Brix increased at first rather rapidly and eafter more slowly. Polarization, purity, acre yield of sugar, and acre yield igar per month increased up to 65 days, but increases thereafter were not :ing and all of these factors declined after 90 days. Percentage of moisture ine declined slightly and gradually, whereas the fiber percentage increased ipening progressed.

›terminations on soil samples from the upper 3 ft. of the plats showed that moisture dropped to the wilting point, then rose again as a result of 'ers and finally declined once more to the wilting point. Nitrate nitrogen ie soil first fell and then increased. Phosphorus and potassium in the juice 'ed a slight and gradual increase, associated possibly with the slight ease in concentration of cell sap due to drying out.

ider the conditions of the experiment the greatest returns in terms of r per acre per month appeared to be realized when the cane is harvested in from 60 to 90 days after the final irrigation. Overripening may result ss of sugar, loss of growing time for the next crop, and injury to ratoons.

ological differences between winter and spring wheats, I, II [trans.], S. Lewicki (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Puławach (Mém. Natl. Polon. Écon. Rurale Puławy), 8 (1927), A, pp. 147–224, 347–416, figs Fr. abs., pp. 215–224, 402–416*).—The results of studies by genetic methods he biological differences between winter wheat, spring wheat, and non-mal wheat are set forth in detail, and the possibility of improvement of several types is considered. Part 1 deals with hybrids in spring culture

and part 2 with hybrids in winter culture. Extensive French summaries and bilingual tables are included.

Effect of date of seeding of winter wheat on plant development and its relationship to winterhardiness, G. Janssen (*Jour. Amer. Soc. Agron., 21 (1929), No. 4, pp. 444–466, figs. 5*).—This is the second part of a report (E. S. R., 61, p. 334) on seeding experiments with winter wheat (Turkey) at the University of Wisconsin.

Winterkilling of winter wheat plants, determined on date of seeding test trials during three consecutive years, 1923 to 1925, inclusive, was found to vary in percentage, depending upon the date sown. The percentage of winterhardiness followed in decreasing order the seedings of September 21, September 4, October 3, October 17, and August 15, respectively.

The plants from the first seeding showed the greatest development of a fall root system, and were followed in order by plants of the second, third, fourth, and fifth seedings. New root development in the spring usually proceeded from the crowns of the plant. Evidently the old fall roots as a rule do not continue active growth in the spring, but subsequent spring root development continues from the crown. Winterkilling usually did not occur from the fracturing of the roots but because the plants were raised out of the soil, death resulting through desiccation. Plants grown in soil with 10 per cent moisture content endured the winter better and recovered better in the spring than did plants in soil having from 25 to 30 per cent of moisture.

The grain yields for 1922, 1923, and 1924 were directly correlated with the amount of winterkilling. It appeared that a low percentage stand of plants in the spring and also grain yield are not always indicative of a high percentage of winterkilling. This was especially true for the late seedings, namely, October 5 and October 19, from which late seeding dates the greatest heaving of plants resulted which led to plant desiccation. Hence, death of plants in many instances was due to spring desiccation and not to actual winterkilling.

Marquis wheat: Description of the standard type, L. H. Newman and J. G. C. Fraser (*Canada Dept. Agr. Pamphlet 95, n. ser. (1928), pp. 5, pls. 3*).—The history, economic qualities, and distinguishing characteristics of Marquis (Ottawa 15) are told briefly, and the spikes, glumes, and kernels are illustrated in color.

Wheat responds to proper fertilizers, G. M. Grantham (*Michigan Sta. Quart. Bul., 12 (1929), No. 1, pp. 5–7*).—Fertilizer formulas and application rates are suggested for wheat on different soil types.

Weed control in irrigation canals, New South Wales, Australia, T. M. Wilson (*New Reclam. Era [U. S.], 20 (1929), No. 9, p. 137, figs. 3*).—Types of implements used for control of weeds in irrigation canals are described and illustrated.

HORTICULTURE

[Horticultural investigations at the Idaho Station] (*Idaho Sta. Bul. 164 (1929), pp. 11, 31, 32–34*).—Studies of various washes for the removal of spray residues on apples indicated the need of more effective treatments than are now in use in order to meet the world tolerance requirements.

Potatoes, carrots, cabbage, and cauliflower were kept in the storage house of the horticultural department from the fall of 1927 until the summer of 1928, during which time the temperature of the storage house remained practically constant at 40° F. No humidity records were kept. Carrots were in good condition on May 1 and no difference could be detected in the condition of those kept in sand or on shelves. Potatoes were in good condition on June 1 and were

usable for some 2 weeks longer. Cabbage did not keep as well, and cauliflower did not keep either when wrapped or kept on the shelf without wrapping.

Prune storage studies continued from the preceding year (E. S. R., 59, p. 738) showed that the Italian prune may, with careful handling in the orchard and in storage, be held at 32° F. for sufficient time to equalize shipments. The modified Murneek pressure tester proved the most satisfactory measurement of maturity on the tree and in storage. The pressure range 9.5 to 7.5 lbs. on the tree proved satisfactory, the fruit holding up from 3 to 4 weeks after midseason. Uneven ripening on single trees interfered with successful storage, as storage life of fruit was largely determined by that of the ripest specimens. Shriveling caused the greatest losses in storage. Early-picked prunes held up well but failed to develop prime quality. Stored fruit did not keep long after removal from storage.

Noting that losses in sweet cherries from cracking on the tree may reach 50 per cent or more, a study was begun of the factors concerned. Cracking injury in the Lewiston district was associated directly with rains during the ripening period. Osmotic intake of water through the epidermis resulted in a volume increase of the sap sufficient to burst the fruits. Soil moisture conditions were not markedly associated with this injury. The amount of cracking, both in respect to number of fruits injured and the extent of injury per fruit, increased with increasing maturity. Variations observed in the time of ripening within the Lambert variety led to the recommendation of harvesting the earlier trees first. Bing, Lambert, and Napoleon (Royal Ann) ranged in descending order of susceptibility, differences explained in part by different sugar contents at maturity and by differences in the elasticity of the skins. Napoleon showed 64 per cent of cracking with 9.8 per cent volume increase and Bing 100 per cent cracking with 5.4 per cent volume increase.

Study of the seedlings resulting from the apple breeding project begun in 1909 showed an extremely wide range in size, form, color, percentage of acidity, and keeping quality in the various crosses. Seedlings with Ben Davis as one parent showed excellent keeping qualities, even in common storage, but were mostly deficient in other desirable characteristics. Some of the more promising seedlings were propagated for more extensive trial.

Fertilizer experiments with Jonathan apples at Coeur d'Alene and Moscow continued to give negative results. Ammonium sulfate gave certain responses in a Jonathan, Rome Beauty, and Winesap orchard near Wilder, but due to variations in the size of the trees no positive conclusions were drawn. In an Italian prune orchard near Boise 1 lb. of ammonium sulfate per tree gave a 45 per cent yield increase over check trees, deemed significant in view of the uniformity of the trees and the large number involved.

[**Horticulture at the Maryland Station**] (*Maryland Sta. Rpt. 1928, pp. XV, XVI, XIX, XX*).—Among the outstanding results of experimental work mentioned are the value of nitrogen in apple and peach growing, the need of cross-pollination in the apple, the desirability of early training of the grapevine, the possibility of rejuvenating old peach trees and the desirability of light pruning of young peach trees, the superiority of fall and early spring planting for the apple and of early spring planting for the peach, the relation of the time of planting, fertilizing, and inoculation to pea yields, and the value of commercial fertilizer for asparagus, with notes on the time of application. It was found that nitrate of soda was better than sulfate of ammonia for asparagus. Studies in apple propagation showed difficulty in growing root cuttings of varieties, whereas seedlings were readily propagated in this manner. Vigorous seedlings resulted in the largest nursery trees. The male parent of apple seedlings was

found to influence their vigor materially. Using the content of soluble polysaccharides as a measure, a comparison was made between two lots of corn, one having the appearance of field corn and the other of normal sweet corn. Only insignificant differences were found in the soluble polysaccharides of the two lots.

[**Horticultural investigations at the Massachusetts Station**] (*Massachusetts Sta. Bul. 247 (1929), pp. 304, 310, 311, 315, 316, 328, 331–334, 335, 338–340*).—As determined by J. P. Jones, clovers or grasses as cover crops failed to benefit the onion. The application of lime to onions on acid soil was distinctly beneficial.

Studies by L. H. Jones on breaking the rest period of the gladiolus suggested that soil temperature has no definite relation to blooming, except that the best growth occurred between 65 and 85° F. Corms held dormant over summer and planted in early October failed to bloom. Histological examination indicated that flower differentiation occurs about 5 weeks after planting, normally in the period of increasing daylight, and suggests that light may affect blossoming.

Studies conducted at the East Wareham Cranberry Substation by H. J. Franklin, in cooperation with the U. S. Weather Bureau, indicated that wet bulb readings at East Wareham, South Chelmsford, and Worcester are useful indexes to the probable minimum bog temperature. Blueberries were satisfactorily interplanted with strawberries. Slaked lime, 1 lb. to 2 gal. of water, proved a satisfactory control for green moss. Studies of cranberry varieties showed that foliage color, average seed number, and fruit bloom are correlated with varietal productivity and disease resistance. As established by F. W. Morse, disease resistance is generally correlated with a high percentage of total acids in the fruits. Analyses by Morse of samples of Early Black and Late Howes cranberries harvested weekly from late August to October showed little progressive change in acidity, while sugar doubled and water showed a slight percentage decrease. The ash content was less than 0.2 per cent, but iodine and manganese were relatively abundant.

J. K. Shaw and J. S. Bailey, studying the interrelation of stock and scion in the apple, found less stock influence than was expected and suggest that stock influence is more likely to dwarf than to invigorate trees. Clonal stocks from East Malling, England, failed to propagate readily from mounds or from cuttings, but were successfully handled on nurse roots of ordinary seedlings. A freezing apparatus was built for studying bud hardiness in the peach. No distinct differences were noted by Shaw in the quality and quantity of apples produced by young trees pruned in different amounts. Pruning experiments conducted by F. C. Sears and Shaw in an apple orchard nearly 40 years old showed no marked effects of pruning on quality or quantity of fruit.

Application by Shaw of nitrogen to trees which had been in cultivation without fertilizer since 1921 gave marked responses with the Baldwin, with little in the case of the McIntosh. Additional nitrogen supplied to sod-grown trees increased production in Baldwin, with less positive results in McIntosh. Sulfate of potash, on the other hand, showed no responses on Baldwins in sod, with slight evidence in the McIntosh. As reported by Shaw, phosphorus, potash, and lime applied to a sod mulch orchard tended to bring in white clover, and more soil nitrates were found under the clover than elsewhere. In a 30-year-old Baldwin orchard applications of nitrate of soda up to 15 lbs. per tree in addition to adequate phosphorus and potash gave increasing yields. Heavy mulch on apples and pears produced larger crops than did cultivation. The amount of nitrates in the soil under the mulch was greater than in orchards cultivated and fertilized with nitrogen. Shoot growth continued no later on the sod-

mulched trees. Apples, peaches, and grapes planted on an old fertilizer test field showed responses only to potash on limed areas. Peach trees planted in pots filled with soil taken from the field areas behaved in the same manner as did the field trees. Further work in which the soils were treated with lime showed that adding lime to soils which had received potash increased growth and the amount of nitrates in the soil.

Studies by Sears, O. C. Roberts, and others showed Baldwin and Wealthy more or less self-fertile and McIntosh practically self-sterile. Roberts found that certain apple varieties kept well even though they had been subjected to freezing on the trees. Working with the department of entomology, Roberts found excess arsenate only on early varieties or where the trees had been sprayed later than was customary. Light pruning of grapes followed by blossom thinning gave 23 per cent more fruit with no decrease in quality in experiments conducted by B. D. Drain.

At the Market Garden Field Station at Waltham, V. A. Tiedjens found that young asparagus roots could be subdivided much more successfully than mature roots, and discusses the processes of cutting and reestablishment of the plant. Reporting on the genetics of greenhouse cucumbers, Tiedjens states that green fruit color is dominant over white. Orange or bronze fruit color linked with the black spines and dominant over white or green fruit color develops only in the presence of light. Black spines were dominant over white. Parthenocarpy is epistatic to development by fertilization. The location of pistillate flowers on the main stem is epistatic to the allelomorph inhibiting the production of pistillate flowers. Abundant production of laterals is dominant to the absence of laterals. Such characters as size and shape of fruit and number of flowers showed partial dominance and were materially affected by external conditions. Several pure lines of cucumbers were established. Crosses were made between a selection of Whipple Yellow and early Canadian sweet corn in order to secure a cold-resistant, early-maturing yellow sweet variety. From a cross between Belmont and May King lettuces there was obtained a promising new hard heading, moderately mildew-resistant variety designated as Bel-May. Selection work was conducted with the beet and the carrot.

[Horticultural investigations at the Nebraska Station] (*Nebraska Sta. Rpt.* [1928], pp. 18–20).—Comparing light and heavy pruning of newly set 2-year-old Winesap and Jonathan apple trees, it was found that heavy pruning reduced growth somewhat, both in respect to diameter and height, and materially in respect to length of shoots. The leaf area during 1928 was greater on cane-pruned than on spur-pruned grapes. Mulched grapevines made 350.7 ft. of growth per vine as compared with 259.4 ft. for cultivated vines. There was found from two to three times as much nitrate nitrogen in the cultivated as in the mulched plats. Hybrid strawberries yielded less fruit than did the Senator Dunlap.

Superphosphate with or without manure or with or without irrigation had no effect on earliness, vine growth, fruit setting, or yields in the case of tomatoes. Potash gave no response on any vegetable on which tested. Irrigated soils contained less nitrate nitrogen than did nonirrigated soils. The percentage of water in the soil of these plats was in reverse order to nitrates. Straw mulching increased yields over cultivation in all except the irrigated plats. Nitrate of soda generally increased yields in mulched areas, especially when they were irrigated. Cabbage responded particularly well to applications of nitrates. Irrigation increased the total yield of every crop upon which used. The greatest increases were secured in the cultivated plats and the least in scraped plats.

European horticultural research institutions [trans. title], W. Gleisberg (*Gartenbauwissenschaft, 2 (1929), No. 1, pp. 97–132*).—A summary of the present status of experimental work in horticulture in the various European countries outside of Germany.

Ultra-violet light and plant production [trans. title], J. Reinhold and F. Schulz (*Gartenbauwissenschaft, 2 (1929), No. 1, pp. 40–78, figs. 14*).—Experiments at the Dahlem Horticultural Station with various plants grown under ultra-violet, common window glass, and crude glass gave varying results. Based on 100 per cent yield for plants under the crude glass the maximum yields under ultra-violet glass for radish, spinach, lettuce, bush beans, cauliflower, melons, tomatoes, and carrots were, respectively, 110, 123, 107, 131, 95, 96, 109, and 95 per cent. The rooting of tomato and Cotoneaster cuttings were slightly less under ultra-violet glass. In the case of the tomato early ripening was stimulated by the ultra-violet glass. Records taken on the temperature under the three types of glass showed slight differences which were overcome by ventilation. It is suggested that the differences in responses of the various plants may have been due to their behavior under various light intensities.

Preparation of bunched beets, carrots, and turnips for market, W. E. Lewis (*U. S. Dept. Agr., Farmers' Bul. 1594 (1929), pp. II+22, figs. 19*).—Detailed information is presented on the harvesting, grading, bunching, washing, and packing of bunched beets, carrots, and turnips, with notes on types of containers, precooling practices, methods of loading and cooling in transit, and on inspection service at the shipping point. It is emphasized that vegetables should reach the ultimate consumer in a fresh, attractive condition and that rough treatment in the field, packing shed, or in transit materially affects the sale value of the product.

Quality in celery as related to structure, C. B. Sayre (*Illinois Sta. Bul. 336 (1929), pp. 557–588, figs. 16*).—Discussing briefly the anatomical structure of the celery petiole, the author reports on observations made upon the structure and quality of eight varieties of celery grown under different cultural treatments in respect to fertilization, water supply, and method of blanching. Considerable inherent differences were noted in the quality of the eight varieties when grown under similar conditions, the slower blanching types rating higher. Under the conditions of the fertilizer test, deemed unfavorable by the author, no consistent effect attributable to fertilizer was noted.

Comparing three methods of blanching, soil, boards, and paper, on two varieties, no significant differences were noted; all three methods improved flavor. In four of seven varieties, overhead irrigation tended to improve flavor. In one variety flavor was deemed inferior in the irrigated lot. No consistent effect of irrigation on texture was noted.

Microscopic examination of plants taken from the various treatments failed to show any correlation between size or number of fibrovascular bundles and stringiness, one of the most tender, Sutton Giant Red, having unusually large bundles. Size of the bundles was apparently a varietal characteristic. The only tissue that showed any relation to stringiness was the collenchyma, the causative factor being the hardness of the cell walls. Size of collenchyma cells and the thickness of cell walls had no apparent relation to stringiness. Pithiness was traced to the breaking down of parenchyma cells. No bast fiber was found in any of the samples.

A comparative test of tomatoes, A. E. Hutchins (*Minn. Hort., 57 (1929), No. 7, pp. 202–206, fig. 1*).—At the Minnesota Experiment Station in the summer of 1928 Bonny Best, Red River, Earliana, John Baer, Fargo, Stone, and Viking tomatoes were arranged in the above descending order in respect to yields of

ripe fruits. However, when yields to August 28 were considered, the order was Earliana, Red River, Fargo, Viking, John Baer, Bonny Best, and Stone.

Early red, pink, and wilt-resistant tomatoes in 1928 test, R. Magruder (*Ohio Sta. Bimo. Bul. 140 (1929), pp. 165–172*).—The results are presented, largely in tabular form, of a test of tomato varieties conducted with the purpose of clarifying the nomenclature of the newer varieties. Most of the early red-fruited varieties were readily separated into two well-defined groups resembling Earliana and Bonny Best. Two other large groups are distinguished, the pink or purple fruited varieties and the wilt-resistant types.

The mechanical pollination of greenhouse tomatoes, L. M. Montgomery (*Veg. Growers' Assoc. Amer. Ann. Rpt. 1929, pp. 89–93*).—Discussing the nature and necessity of pollination, the author describes a device tested at the Ohio State University for jarring at one time all of the tomato plants growing in a greenhouse.

The pollination of the Champlain (Nyack Pippin) and the Lily of Kent apples, F. S. Lagassé (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 141, 142*).—Controlled pollination studies at the Delaware Experiment Station showed the Champlain and the Lily of Kent apples to be self-sterile. Rome was a satisfactory pollinizer for Champlain, and Delicious and Grimes for Lily of Kent. Actual brushing of Lily of Kent stigmas with Lily of Kent pollen failed to increase the set above that of unbrushed blooms.

The use of individual branches of a peach tree to show comparative results on time of thinning, A. J. Olney and C. S. Waltman (*Ky. State Hort. Soc. Trans., 1928, pp. 65–68*).—Peach-thinning studies carried on with individual limbs of a single tree as units of comparison showed uniformly best results from fairly early thinning. For thinnings 42, 57, and 74 days after bloom the increases in the case of June Elberta were 51.6, 35.8, and 13.1 per cent; for Carman 63.7, 53.2, and 31.8 per cent; and for Hiley 59.1, 12.6, and 10.6 per cent, respectively. The volume of the fruits removed was determined by water replacement in a graduated flask.

A study of the effect of commercial fertilizers on the performance of peach trees, J. R. Cooper and C. B. Wiggans (*Arkansas Sta. Bul. 239 (1929), pp. 62, figs. 4*).—This is a second report (E. S. R., 55, p. 341) on fertilizer studies with the peach, dealing in this case with results of experiments on the Greenville soil type, dominant in the peach-producing districts of south-central and southwestern Arkansas. As in the first series of experiments, nitrogen was again found to be the principal, if not the only, substance which gave material returns. The gains from phosphorus were so small and inconsistent as to be deemed of doubtful value, and potash in the form of kainite did not prove beneficial in any way.

Nitrogen in quickly available forms gave very definite increases in growth and production. The time of application of nitrogen, (1) before blooming, (2) when the fruit was ¾ in. in diameter, and (3) after harvest, had no material influence on production, suggesting that there is no critical period in the peach, especially in trees of normal vigor and condition. Dividing the application of nitrogen was not beneficial. Nitrogen retarded ripening approximately four days at the peak of the harvest, increased the number of fruit buds per unit length of terminal growth by approximately 0.2 bud per inch, and increased the set of fruit by about 4 per cent.

No fertilizer had any material effect on the size of fruits nor on quality or firmness of fruits. It was observed that fertilizer by increasing foliage may decrease the color of the fruit. The only influence of fertilizer on hardiness of buds was indirect by influencing maturity. Winter mortality was less on

short than on longer growths of any one tree, but was greater on those trees making only short growth. A positive correlation was determined between production and growth, as measured by girth increase and terminal elongation. A high degree of inverse correlation was found between terminal growth and fruit color and between yield and size of individual peaches.

A bibliography of 184 references is appended.

Rodent injury of fruit trees, C. W. Ellenwood (*Ohio Sta. Bimo. Bul. 140 (1929), pp. 160–164*).—Information of a practical nature is given on the protection of fruit trees from rabbits, mice, and ground hogs, with notes on bridge grafting as a means of saving badly injured trees.

Observations on the refrigeration of some Illinois fruits in transit, J. W. Lloyd and H. M. Newell (*Illinois Sta. Bul. 334 (1929), pp. 509–544, figs. 5*).—Temperature records taken in a total of eight cars of fruit, five peaches, two strawberries, and one apple, at the time of loading and in transit show quite definitely the desirability of precooling the fruit, of careful loading, and of providing the maximum circulation of air in the car.

In respect to loading practice, it was found that floor racks hastened the rate of cooling and caused greater uniformity in temperature throughout the car. Arranging the packages so that air might circulate readily facilitated cooling as compared with closely packed cars. Electric fans increased the rate of air circulation and thereby hastened cooling. Peaches loaded when relatively cool reached a safe carrying temperature more rapidly than did peaches in cars cooled by adding 2 per cent of salt at the initial and subsequent icings, despite the fact that salt increased the rate of cooling. Salt proved most beneficial when added to the initial icing. In the case of strawberries floor racks proved more beneficial than did the addition of 2 per cent of salt to the initial and subsequent icings.

Blackberries, raspberries, and dewberries, H. G. Swartwout (*Missouri Sta. Bul. 265 (1929), pp. 31, figs. 17*).—A general discussion of the various phases of bramble fruit production, including propagation, choice of nursery stock, soil preparation, planting, fertilization, cultivation, pruning, harvesting, varieties, pollination, and disease control. All of the varieties of blackberries tested except McDonald and all of the varieties of raspberries tested without exception proved self-fruitful.

Changes in the rate of respiration of the fruits of the cultivated blueberry during ripening, H. F. Bergman (*Science, 70 (1929), No. 1801, p. 15*).—Studies made upon ten varieties of blueberries gathered at three stages of maturity, green, pink to red ripe, and blue ripe showed the greatest production of carbon dioxide in fruits of the second stage. After the stage of full red coloration the rate of carbon dioxide output decreased rapidly to the blue stage at which fruit is normally picked. Rubel, with the slowest rate of carbon dioxide production, was also the best keeping variety.

The influence of position of buds on the development of clusters of Muscat of Alexandria and Molinera, A. J. Winkler (*Amer. Soc. Hort. Sci. Proc., 25 (1928), pp. 207–209*).—In the case of cane-pruned Muscat of Alexandria vines, half of which were partly deflorated by leaving only the buds at the base of the canes and half by leaving buds only at the end of the canes, the yields were practically equal. In a second experiment with cane-pruned Muscat vines in which four buds were retained at the base, at the center, and at the ends of canes there were no significant differences attributable to the position.

In a third experiment with cane-pruned Muscat and Molinera vines in which the flower clusters of half the vines were thinned and in the other half undisturbed, no significant effect of bud position on cluster length was evident, the

highest coefficient of correlation between position of bud and length or weight of cluster being only 0.1609±0.051. The weight and length of clusters of flower-thinned and nonthinned Muscat vines were strikingly in favor of flower thinning at all positions.

It is concluded that nutrition rather than position on the cane is a controlling factor in these two varieties.

Identification of certain species of citrus by colorimetric tests, F. F. Halma and A. R. C. Haas (*Plant Physiol., 4 (1929), No. 2, pp. 265–268*).—Distinctive coloration for the sweet and sour oranges, the grapefruit, and the rough lemon was obtained upon boiling the filtered solutions of powdered bark after the addition of the Almén reagent in one case and of saturated solution of copper sulfate (after adding potassium hydroxide) in the other. In the case of the copper sulfate treatment sweet orange bark solution became pink, sour orange brown, grapefruit light pink, and rough lemon almost colorless. Supplementary tests are suggested. Since the Lisbon and Eureka lemons gave a characteristic rusty red color quite different from that of the rough lemon, although usually included in the same species, the authors suggest the possibility that these colorimetric differences may assist in citrus classification.

The Japanese persimmon in Florida, A. F. Camp and H. Mowry (*Florida Sta. Bul. 205 (1929), pp. 525–562, figs. 22*).—A general discussion on the character and nature of the fruit, the history of its introduction into Florida, botanical characteristics, varieties, pollination requirements, propagation, culture, and the handling of the fruit.

Fertilization of shade trees.—Part I, Fall vs. spring fertilization, H. L. Jacobs (*Davey Inst. Tree Surg. [Kent, Ohio] Bul. 4 (1929), pp. 28, figs. 8*).—In comparing spring and fall applications of a complete commercial fertilizer upon Norway maples, American elms, and apple trees, the author found but little difference due to the season of application but did find a decided benefit resulting from the use of fertilizer as compared with none.

The effect of temperature on flowers, F. M. Andrews (*Plant Physiol., 4 (1929), No. 2, pp. 281–284, fig. 1*).—Experiments at the Indiana University with eight species of Crocus placed in electrically controlled chambers, described in detail, showed that the flowers of the species *C. vernus* when at the proper stage of development may respond to changes of temperature of less than 0.5° C. In fact, increases of 0.2° caused perceptible opening of the petals. In the case of Tulipa no flowers responded to changes of less than 1°.

Forcing experiments with calcium cyanide [trans. title], **G. Gassner and H. Rabien** (*Gartenbauwissenschaft, 2 (1929), No. 1, pp. 1–23, figs. 10*).—The rest period of the lilac, lily of the valley, deutzia, and astilbe was successfully shortened by treatment of the plants with hydrocyanic acid gas.

Bulb flowers worth trying, J. H. Painter (*[Oklahoma] Panhandle Sta., Panhandle Bul. 8 (1929), pp. 3–6*).—Notes are given upon the culture of spring-flowering bulbs, with suggestions in regard to varieties.

Rose culture in Bulgaria [trans. title], **A. Eibl** (*Gartenbauwissenschaft, 2 (1929), No. 1, pp. 24–39, figs. 4*).—A general discussion of the species grown, chemical and physical characteristics of soils utilized, culture, propagation, yields of oil, distillation methods, etc.

FORESTRY

[Farm forestry at the Idaho Station] (*Idaho Sta. Bul. 164 (1929), pp. 30, 31*).—Windbreak studies were continued (E. S. R., 59, p. 745) and again indicated that windbreaks have both a beneficial and a detrimental effect on

field and orchard crops. Trees or other plants adjacent to the windbreak may be injured by competition for soil nutrients, soil moisture, and light. The zone of injury extended both sides of the windbreak to a distance about equal to the height of the windbreak. A ditch dug deeply between the windbreak and the crop tended to reduce injury. Beneficial effects of windbreaks extended over a zone of about 20 times the height of the windbreak. Windbreaks lessened the evaporation, and in case of severe winds reduced possible injury. Spraying was facilitated by windbreak protection.

In addition to protection, windbreaks are potential sources of forest products for the farm, and in some cases it was found that black locust or Russian olive may return as much revenue as would crop plants occupying the same area. Windbreaks thus constitute a threefold asset—protection, source of forest products, and improved appearance of the ranch.

Summary of first year's hardwood investigations in Louisiana, G. H. Lentz (*Jour. Forestry, 27 (1929), No. 5, pp. 486–494*).—Stating that in 1926 over 12 per cent of the total hardwoods in the United States came from Louisiana, the results of a preliminary survey made in 1928 of the hardwood resources on the bottom lands of Louisiana are presented, including records of habitats and species, fire and high water damage, growth and yields, and present methods of cutting and utilization. An annual growth of 500 bd. ft. is deemed possible on the rich bottom lands under skilled management.

Forestry in Minnesota, E. G. Cheyney and O. R. Levin (*St. Paul: Minn. State Forest Serv., 1929, pp. 55, figs. 12*).—General information is presented on the forests and forest administration, with notes on policies in reference to lumbering, fire prevention, development of recreational facilities, reforestation, etc.

Seedlings and sprouts have different value, R. H. Westveld (*Michigan Sta. Quart. Bul., 12 (1929), No. 1, pp. 7–9*).—Forest growth may be classified into four groups, namely, seedlings, sprouts, seedling sprouts, and suckers, each of which has individual characteristics and qualities which make their retention in the forest dependent largely on the purpose for which the wood is being grown. An examination of 200 stumps, including red oak, white oak, hard maple, elm, black ash, black cherry, soft maple, basswood, tulip, poplar, hickory, and sassafras showed only two species which did not reproduce by sprouts from the stump. Sprouts grew more rapidly at first but were found to rot more readily because of their attachment to the old stump. Of 155 sprouts examined, 60 were partially decayed at the base, and a total of 70 per cent of the diseased trees were over 10 in. in diameter. Less than 5 per cent of the seedlings were decayed. Sprouts generally occur in clumps, necessitating early thinning to avoid crooked trunks. Sprouts are deemed satisfactory in cordwood production but not for saw timber, in which case seedlings are desirable.

DISEASES OF PLANTS

Plant pathology (*Idaho Sta. Bul. 164 (1929), pp. 34–37*).—The results are briefly reported of studies on rugose mosaic, mild mosaic, leaf roll, and spindle tuber of potatoes. By isolation and careful roguing of the plats, rugose mosaic, leaf roll, and advanced spindle tuber were practically eliminated. For the control of mild mosaic tuber indexing was tested, but seed tubers that appeared to be free from the disease in the field developed mild mosaic when grown in the greenhouse.

Tests of clovers are said to have shown varying resistance to mildew. Dusting the plants with sulfur when the disease appeared and again whenever necessary held the disease in check.

Typhula graminum was isolated from wheat affected with a sclerotium disease, and the same or a similar organism is said to have been found on lawn grass at the station.

For the control of grain smuts, the formalin spray treatment is said to have been the most efficient and economical method in controlling oat smut. Some of the organic mercury dusts gave satisfactory control, but their use was more costly.

Breeding experiments resulted in the discovery of several strains of tomatoes that are said to be comparatively resistant to curly top.

Treating beans before planting with copper carbonate and several organic mercury compounds proved of no advantage for disease control. Studies of bean mosaic resulting from infection from beets affected with curly top resulted in the conclusion that while curly top mosaic is present in bean fields near leafhopper breeding areas, the disease is not responsible for all the losses that have been generally attributed to it. Six selections from the variety Great Northern have continued to be free from mosaic. Bean plants from seed of infected plants averaged higher percentages of mosaic than plants from seed which had been infected during the season of growth.

Cooperative experiments with the U. S. Department of Agriculture on the stripe rust, *Puccinia glumarum*, of wheat showed that the urediniospores remained viable for a longer time when kept at a temperature of 10° C. in a humidity of 49 per cent than at any other temperatures and humidities tested. Freezing the teliospores for from 3 to 5 days increased germination.

Department of botany (*Massachusetts Sta. Bul. 247 (1929), pp. 306–310, 311, 312*).—Summary accounts are given of investigations carried on by the department during 1927 and 1928. Some of the results have been noted previously.

Tobacco diseases, W. L. Doran (pp. 306–308).—Additional data are given on the relation of soil reaction to the occurrence of black root rot of tobacco that are said to confirm previous results (E. S. R., 58, p. 750). Acetic acid, previously reported as a soil fungicide (E. S. R., 59, p. 239), was again successfully employed for the disinfection of tobacco seed beds infested with Thielavia and damping-off fungi.

Data are given on the soil-temperature relations of the tobacco plant as correlated with the presence of lime in the soil and in the absence of Thielavia.

No infection of alfalfa by Thielavia was found in limed plats known to be infested with the fungus.

In continuation of experiments previously reported on the brown root rot of tobacco as influenced by a previous crop of timothy (E. S. R., 59, p. 243), additional data were secured that support the author's hypothesis that brown root rot is due to toxic substances formed by slowly decaying vegetable matter such as timothy. Soil treatments with formaldehyde and acetic acid reduced brown root rot, but sulfuric acid and nitric acid were without effect. Acetic acid and orthophosphoric acid increased the yield of cured tobacco on land that had previously grown a crop of timothy. In a series of plats brown root rot on tobacco was severe when that crop followed alfalfa, timothy, and alsike clover grown in rotations.

Control of diseases of greenhouse vegetables, E. F. Guba (pp. 308, 309).—A brief account is given of studies on the control of leaf mold of tomatoes with sulfur by a method previously described (E. S. R., 61, p. 448). Ventilation and proper watering were found to be important in controlling the disease.

Downy mildews of cucumber and lettuce, W. L. Doran (pp. 309, 310).—Investigations showed that the youngest leaves of cucumbers are not readily infested

by downy mildew, *Pseudoperonospora cubensis*, and that rain is the most important factor in the rapid dissemination of the fungus. In the greenhouse the disease was checked by the removal of infected leaves when first seen and by maintaining a low humidity.

Some preliminary studies are reported on the lettuce downy mildew, *Bremia lactucae*. Bordeaux mixture was found to be injurious to seedling plants. Varietal differences in respect to susceptibility to downy mildew were found, the variety May King being very resistant and Belmont susceptible.

Eradication of nematodes and parasitic fungi in greenhouse soils, L. H. Jones (p. 310).—Experiments are said to have shown that two applications of acetic acid and calcium cyanide completely eradicated nematodes in greenhouse soils. Keeping the water-holding capacity of the soil above 80 per cent is reported to have reduced gall formation on tomato roots, but flooding the soil for a month did not destroy all the nematodes. Extreme drought gave complete eradication, none of the nematodes surviving more than two weeks under air-dry conditions.

Carnation blight, E. F. Guba (p. 311).—The relation of syringing plants for the control of red spider to blight caused by *Alternaria dianthi* is pointed out. Studies on the effect of fungicides on the germination of the spores of the fungus were made, and Bordeaux mixture was found toxic, as was also copper dust if moisture was present on the plants. Complete coverage of the foliage was secured by the addition of 0.3 per cent fish oil or linseed oil to the dilute fungicide.

Eggplant wilt, E. F. Guba (pp. 311, 312).—Tests of varieties of eggplants are said to have shown no evidence of resistance to wilt caused by *Verticillium alboatrum*. Paper mulch is said to have given some indication of control, probably through a reduction of the soil temperature below that required for the growth of the fungus.

Fungus parasites of grasses, W. H. Davis (p. 312).—Brief accounts are given of *Sclerotium rhizodes*, which is said to reduce the carrying capacity of pastures and yields of hay; of brown patch caused by *Fusarium* sp. and *Rhizoctonia solani;* snow mold; and a striped smut, *Ustilago striaeformis*. Mercuric compounds are said to have controlled the large brown patch due to Rhizoctonia. Biologic forms of the striped smut are reported.

A leaf spot disease of Chinese cabbage caused by an Alternaria, W. H. Davis (p. 312).—A brief account is given of a disease of Chinese cabbage that is said to be caused by a fungus physiologically identical with *A. brassicae*.

Plant diseases (*Nebraska Sta. Rpt. [1928], pp. 28–31*).—As a result of a survey alfalfa wilt was found to be present in most sections of the State. It is believed that the disease is correlated to some extent with winter hardiness of alfalfa, the less hardy strains in general being most susceptible. However, Grimm, a very hardy variety, is said to be extremely subject to wilt. Thus far all attempts to isolate an organism from seed taken from diseased plants or from soil have given negative results.

Several secondary fungi were isolated from wilted plants, and the organisms are considered to be contributing factors in the destruction of alfalfa stands. Three species of Fusarium that cause root rots were isolated, and a species of Fusarium was also recovered from seedling plants. Roots showing scurf and depressed lesions yielded a species of Rhizoctonia.

In continuation of experiments on the control of seed-borne diseases of potatoes (E. S. R., 59, p. 840), the hot formaldehyde treatment is said to have given the most effective control of scab and Rhizoctonia. Corrosive sublimate treatments were found to be ineffective in some experiments for scab control,

but gave good control in others. Organic mercury treatments were not sufficiently effective to warrant their recommendation, but they were somewhat more effective for the control of Rhizoctonia than for scab control.

Further study of spindle tuber and other degeneration diseases of potatoes is said to have shown that what was formerly considered a severe type of spindle tuber is a distinct disease to which the name unmottled curly dwarf is given. The new disease is briefly described, and the same environmental factors were found to influence it and spindle tuber. Both spindle tuber and unmottled curly dwarf were successfully produced by inoculating green tops of potato plants with the juice of infected plants.

Other degeneration diseases reported as under investigation are giant hill, supermild mosaic, and haywire. The last-named disease is said to be carried by the tubers without any indication of disease symptoms. The effect on the plant is said to be very severe.

New or little known phytoparasites in Argentina [trans. title], J. B. MARCHIONATTO (*Rev. Facult. Agron. La Plata, 3. ser., 18 (1928), No. 1, pp. 21–29, figs. 5*).—This account deals briefly with *Phyllosticta glaucispora* on leaves of *Nerium oleander*, *Phoma citricarpa* on branches of *Citrus limonia*, *Septoria graminum* on leaves of *Avena sterilis byzantina*, *S. melissae* on leaves of *Melissa officininalis*, *Phlcospora ulmi* on leaves of *Ulmus campestris*, *Fusicladium eriobotryae* on leaves of *Eriobotrya japonica*, *F. pirinum* on leaves of *Crataegus pyracantha*, *Cercospora cerasella* on leaves of *Prunus cerasus*, and *C. neriella* on leaves of *N. oleander*.

Report on the Phytopathological Experiment Station for 1926 [trans. title], G. LÜSTNER (*Landw. Jahrb., 66 (1927), No, 1, pp. 365–372*).—The phytopathological part of this report gives a brief account of perithecia formation in oak mildew (*Microsphaera alni extensa*), tomato canker (*Didymella lycopersici*), a stem rot (*Sclerotinia libertiana*), *Dianthus barbatus* rust (*Puccinia arenariae*), rhododendron disease (*Pestalozzia guepini*), a heart rot of *Statice* sp., a leaf spot of *Crateaegus oxyacantha*, somewhat resembling that of pear, due to *Entomosporium maculatum*, the elm tree disease (no bacteria observed), and *Dilophospora graminis* on wheat. A few insect pests are also indicated.

[**Plant diseases and plant protection**], [R.] SCHANDER (*Landw. Jahrb., 66 (1927), No. 1, pp. 215–251, figs. 4*).—This portion of the report on plant diseases and protection deals with scientific activities, including those connected with wheat, potatoes, beets, and fruit and vegetables taken together.

Horticultural plant disease control [trans. title], HÖSTERMANN (*Landw. Jahrb., 66 (1927), No. 1, pp. 414–418, figs. 3*).—This part of the report on the scientific sections deals briefly with control of tomato brown spot (*Cladosporium fulvum*), the resistance of iris species to *Heterosporium gracile*, the control of that parasite, and leaf partial scorching ascribed to sulfur dioxide

Diseases of crops, D. CLOUSTON (*India [Dept. Agr.] Rev. Agr. Oper., 1926–27 pp. 59–61*).—Dealing briefly with investigations bearing on plant protection which have not yet reached the stage of practical application, this report states that in 28 localities mosaic has been shown to occur, affecting numerous cane varieties. As in other countries, mosaic in India may be transmitted by sets or by injection into the leaf and the leaf sheath. It passe from one cane variety to another, and from cane to maize or sorghum, infection occurring naturally. Inferentially, roguing should be carried out i Bihar as early as May 1, when 75 per cent of the mosaic plants should b discernible. Infected red Mauritius canes showed deficiency as regards statur Lower germination may also be a drawback.

A disease of betel causing loss in Bengal proved to be due to *Phytophthora* sp., *Rhizoctonia solani*, and *Sclerotium rolfsii*. Supposedly *Phytophthora* sp. is the active agent during the monsoon, *R. solani* in the cold weather, and *S. rolfsii* in hot weather.

The fungus *Piricularia oryzae* causing paddy blast is under study. Excessive nitrogen may increase susceptibility.

Areca palm stem-bleeding disease is remedied by excision of diseased tissues and the application of hot tar as antiseptic.

Experimental data collected at Dharwar in Bombay Presidency suggest that high organic matter content reduces wilt injury to cotton plants, also that by suitable cultivation the temperature of the soil can be raised sufficiently to kill off the fungus. Cotton boll shedding is being attacked through a method regulating soil moisture late in the season. Cotton wilt appears to be of physiological origin. Diseases attacking stored potatoes are being investigated.

The red cotton bug *Dysdercus cingulatus* is found to carry *Nematospora coryli* and *N. gossypii* causing internal cotton boll disease. These fungi have been found also on four other species of plants. In Mysore, preliminary trials have shown that alum-Bordeaux mixture, though cheaper than lime caseinate, is equally effective as a spray against *Phytophthora arecae*.

The value of organic mercury compounds as seed disinfectants, W. H. Martin (*N. J. State Hort. Soc. Proc., 1927, pp. 9–17*).—Studies are briefly reported in tabular form as conducted to test the value of the organic mercury compounds for the control of seed-borne diseases of ornamentals, peas, corn, potatoes, and sweetpotatoes. The tests as here reported and discussed show the value of these compounds in case both of sweet and of white potato. The results outside of these have not been so outstanding. Corn root rot is better dealt with through the use of disease-free strains, though disinfection even in such cases is a comparatively inexpensive form of insurance against loss if conditions happen to favor disease.

Further evidence of physiologic races of oat smuts, G. M. Reed (*Mycologia, 19 (1927), No. 1, pp. 21–28*).—Reviewing the work and data previously noted (E. S. R., 56, pp. 650, 651), the author gives an account of additional investigations carried out with a large number of collections of both *Ustilago avenae* and *U. levis* from many sources, but as yet, however, in connection with only a comparatively small number of oat varieties.

So far as determined, most of the collections of smut show no marked differences when compared with the Missouri races. Some new races, however, of both loose and covered smuts have been isolated, which prove to be of special interest, and accounts, with tabulations, are given of tests.

Results shown are considered to confirm the earlier data as to the behavior of *U. avenae* and of *U. levis* on the varieties grown. "Although both are capable of attacking a large number of varieties belonging to the different species of oats, yet they can be differentiated by differences in their capacity for infecting certain varieties."

Control of stinking smut of wheat, J. D. Sayre (*Ohio Sta. Bimo. Bul. 140 (1929), pp. 150–152, figs. 3*).—As a result of a test of a large number of dusts for the control of stinking smut of wheat the author concludes that while some commercial products were slightly more effective than copper carbonate in the control of smut, on account of their higher cost it is to be preferred.

Wheat scab damages Michigan grain crops, R. Nelson (*Michigan Sta. Quart. Bul., 12 (1929), No. 1, pp. 15–18, figs. 3.*)—The author reports that the season of 1928, by reason of the abundance and distribution of rainfall, was especially favorable for scab of barley, rye, oats, and wheat caused by *Gibberella*

zubinetti. When scabby seed was sown in 1929 there was much seedling blight ue to the fungus, especially of barley and oats. The relation of the scab ungus to corn root rot is pointed out, and it is recommended that susceptible ereal crops should not follow one another in rotations.

For the control of wheat scab, grading the seed, using the best grade available, avoiding too late sowing, and treating wheat with copper carbonate for smut control, are suggested.

Bean anthracnose and heredity [trans. title], H. TEN DOORNKAAT KOOLMAN (*Forsch. Geb. Pflanzenkrank. u. Immunität Pflanzenr. No. 4 (1927), pp. 112–225, pls. 7, figs. 14*).—This is a systematic account, with bibliography, of research regarding the possibility of immunizing *Phaseolus vulgaris* against *Colletotrichum lindemuthianum* through the breeding of immune varieties. The varietal results and their values as provisionally ascertained are detailed.

Mosaic in field bean [trans. title], K. BÖNING (*Forsch. Geb. Pflanzenkrank. u. Immunität Pflanzenr. No. 4 (1927), pp. 43–111, figs. 22*).—In what is termed a contribution on mosaic in the Papilionaceae, the author deals in descriptive and discussional detail with the mosaic disease of *Vicia faba* as regards its other possible hosts, its features, phases, transmission, agricultural significance, and control.

The presence and distribution of field bean mosaic are related closely to the activities of certain insects. Of these particularly aphids, Cicada, and thrips play normally a relatively small part, except possibly when abundant, as sometimes in summer, at which times the plants are not so readily affected. The question of field bean mosaic control, therefore, becomes largely a question of aphid control.

Intracellular bodies in tissue of mosaic beets [trans. title], E. SCHAFFNIT and H. WEBER (*Forsch. Geb. Pflanzenkrank. u. Immunität Pflanzenr. No. 4 (1927), pp. 23–42, figs. 6*).—In studies of the growing points of material which besides beet included bean, vetch, cucumber, tomato, tobacco, nightshade, and raspberry, and which made use of various coloring and fixing materials and technic as described, a number of bodies were found which were thought to bear some significant relations to the mosaic effect in question. The nature of these bodies was not disclosed by these investigations, though they are thought to be neither artifacts nor protozoa.

The cause of a chlorosis of corn, J. P. JONES (*Massachusetts Sta. Bul. 247 (1929), p. 304*).—It is claimed that a type of chlorosis of corn studied is caused by a lack of magnesium, and that the disease may be controlled by applications of high magnesian lime and by magnesium sulfate.

Sulfuric acid treatment of cotton seed, R. G. ARCHIBALD (*Soil Sci., 23 (1927), No. 1, pp. 1–3*).—In experimentation carried out with H_2SO_4 to test the effect, on the germination of cottonseed, of sulfuric acid, often used as a preventive measure against the bacterial cotton disease now known—according to the part affected—as angular leaf spot, black arm, or boll rot, or the fungus disease known as anthracnose, it was found that seed treated in the proportion of 100 cc. of the concentrated acid to 500 gm. of the seed, washed for 10 minutes in 2 liters of water, dried, and sown, gave a germination rate of 95 per cent, while seed so treated with acid and stored for 6 months before planting gave a germination rate of 92 per cent. Seed treated for a period longer than 1 hour or washed for more than 1 hour after the treatment was adversely affected as to germination. Field observations established better germination and subsequent growth in case of the treated seed.

The sulfuric acid treatment does not completely sterilize the seed as regards black arm, infection when this is present, but it appears to give benefit by delaying the manifestations of black arm in the cotton plant. (See also below.)

Black arm disease of cotton with special reference to the existence of the causal organism B. malvacearum within the seed, R. G. Archibald (*Soil Sci., 23 (1927), No. 1, pp. 5–10, pl. 1*).—Attention is given to the question as to whether black arm, due to *Bacterium malvacearum*, is carried within the cottonseed or on its appendages.

It is stated that the seed appears to be the main source of infection, that *B. malvacearum* can be recovered from the tissues within the seed coat, and that a technic for that purpose is available. Owing to the feeble powers of resistance of this organism to such conditions as strong sunlight, desiccation, or high temperature, it is thought important that the outer covering of the seed, with its coat and fuzz, harbors the viable infecting material. The organism can be recovered from tissues apparently healthy below the black arm lesions. The causal organism has not been found in soil or water, and the disease is supposedly not insect borne. No hosts other than the cotton plant have been found. Seed sterilization with concentrated sulfuric acid has yielded disappointing results. It is thought that a more effectual way of attacking the problem is to ascertain the factors that predispose to infection, and to develop a type of plant capable of resisting the infection as well as of throwing it off when attacked.

[Sugarcane diseases in Queensland] (*Queensland Agr. Jour., 28 (1927), Nos. 3, pp. 208–211; 5, pp. 444, 445*).—Notes, accredited to E. J. F. Wood, state that top rot of sugarcane, long designated as Burdekin (top) rot, has caused much loss to farmers of the lower Burdekin district, and present the facts now known, theories of the growers, and views of the pathologist. The causal agent is thought to be a bacterium. It is regarded as certain that previously clean fields may show infection in the plant crop, and that infected plants do not themselves necessarily reproduce directly or transmit the infection. The disease may be favored by the somewhat unnatural moisture conditions which frequently prevail. Losses are at times heavy. The whole of the Burdekin district is affected to some extent, Badila being the main variety attacked, though damage to other varieties is reported. The period of infection is roughly November to February, inclusive, one stage of the disease appearing when the plant is just beginning to make cane, the other when the cane is about 3 or 4 ft. long. Apparently, top rot is markedly different from the type known as vascular disease. Descriptive details are given.

The bacterium apparently exists over a wide area, attacking severely on the occurrence of certain favoring factors. "There is apparently either a case of very balanced parasitism or of a facultative parasitism by an organism which is usually harmless. This will have to be determined in the laboratory, and in the course of these investigations we may be able to derive the source of the organism." Possibilities are indicated that Badila is quite susceptible and H. Q. 426 tolerably resistant. Leaf shape or texture may factor here.

Notes are also given on the pink sclerotial disease of the leaf sheath, for which two descriptive names, spindle top and needle top, have been proposed. The sclerotial form binds the upper leaf sheaths, choking and killing the growing point and stem. A secondary rot then sets up. The disease had become widespread in 1927, causing losses exceeding five tons per acre. Weather is a determining factor. Assumptions and recommendations are detailed.

Brown root rot, H. F. Murwin (*Massachusetts Sta. Bul. 247 (1929), pp. 341, 342*).—In cooperation with the Bureau of Plant Industry of the U. S. Department of Agriculture, studies were made of the comparative effects of preceding crops on the growth of tobacco in healthy and infested soils.

Tobacco is said to have made good growth following tobacco, fallow, and oats, on both healthy and infested soils. The detrimental effect of corn, alfalfa,

clover, timothy, and soybeans on the tobacco crop was marked, and the effect of potatoes and field peas was intermediate. No beneficial effect on tobacco was found with any crop except oats, and with this crop the yield was no greater than in the case of tobacco following tobacco or fallow. It is claimed that brown root rot has never resulted from continuous culture of tobacco on healthy soils, and that the yield of tobacco has invariably improved from one year to the next with continuous culture on infested soil. These results were obtained on rather acid soils, no data having been obtained on less acid plats.

From his experiments, the author concludes that brown root rot is, in the majority of cases, the result of some crop effect. It is believed that continuous culture of tobacco should be adopted, avoiding rotations when they are not necessary for other reasons.

Irish blight of tomatoes, J. H. Simmonds (*Queensland Agr. Jour., 28 (1927), No. 5, pp. 453–455*).—This account of *Phytophthora infestans* recommends destruction of material that is presumably infective, rotation, and application of Bordeaux mixture.

Spotted wilt of tomatoes, J. H. Simmonds (*Queensland Agr. Jour., 28 (1927), No. 1, pp. 28–30, fig. 1*).—During the previous season, losses were sustained by tomato growers due to the appearance of a disease, hitherto unrecorded for this State, which appeared in Victoria in 1915-16. This was later described by Brittlebank (E. S. R., 43, p. 154) under the new name spotted wilt, proposed by him on account of the characteristic symptoms, which are described. This disease has not yet been causally connected with any parasite, nor has any certain means of control been worked out. Recommendations include the immediate destruction of plants showing disease, spraying with a contact insecticide to control possible disseminators, avoidance of heavy nitrogenous manuring, and early removal of all crop remains as soon as profitable bearing is past.

Critical remarks on certain species of Sclerotinia and Monilia associated with diseases of fruits, J. W. Roberts and J. C. Dunegan (*Mycologia, 19 (1927), No. 4, pp. 195–205*).—With a view to the correction of the confusion alleged to have existed regarding the taxonomic position of certain species of Sclerotinia and Monilia which cause diseases of fruits, the authors propose certain dicta, by the guiding use of which in a critical review of the literature and their own studies they have concluded that two species occur on drupaceous and pomaceous fruits in America. One of these is the common brown ro fungus, different from any known European form, and the other a recentl discovered form occurring along the Pacific coast which is similar to or possibl identical with *M. cinerea* of Europe, though no perfect stage of this has bee found in this country. "*S. fructigena* is a valid name for a fungus occurrin in Europe but not known to occur in the United States."

Apple scab and fruit spot control studies in 1927, W. H. Martin (*N. State Hort. Soc. Proc., 1927, pp. 71–81*).—The results of tests indicate the valu of early spray applications to control apple scab. Concentrated lime sulfu though efficient as regards control of scab, is likely to cause injury. Dry mi when used from petal fall, will control scab without injury. Colloidal sulf is more efficient than are coarser sulfurs. Sulfur dusts, starting at the 7 17 day applications, give good scab-control results.

Fruit spots were not satisfactorily controlled by the use of sulfur either dust or colloidal form or as concentrated lime sulfur. Copper dust gave som what better results. Almost perfect control was obtained with copper colloidal form or in Bordeaux mixture. Perfect control followed the use 2–6–50 Bordeaux mixture following the regular spray treatment. On bloc

treated with copper in either dust or spray much fruit russeted severely. It is questioned, however, whether this is as objectionable as is fruit spot, and also whether this trouble may not be eliminated by using 1 lb. of copper sulfate to 50 gal. of water.

Cranberry disease work, H. J. FRANKLIN (*Massachusetts Sta. Bul. 247 (1929), pp. 314, 315*).—A report is given of investigations carried on in cooperation with the U. S. D. A. Bureau of Plant Industry.

Studies of the false blossom disease are said to have shown that the variety McFarlin was the most immune of all the varieties studied. Early Black was only moderately affected, but Howes, the standard late variety, was very susceptible. The disease was found to be most serious on bogs that were flooded but little during the growing season.

Some evidence was secured which is believed to indicate that the disease is carried by insects from diseased to healthy plants, and that probably the blunt-nosed leafhopper, *Euscelis* spp., is the principal carrier.

Studies of the fairy ring fungus showed that it spreads through the soil, destroying the plants in increasing rings.

Raspberry cane spot and its control, R. V. HARRIS (*East Malling [Kent] Research Sta. Ann. Rpt., 15 (1927), pt. 3, pp. 57–63, pls. 3*).—The present account deals with field control measures successfully tested at East Malling. It is recommended that in new plantations the planting of very susceptible varieties be avoided, or else that the cane be severely cut back and all the prunings be burnt, and that on established plantations the cankered or spotted canes be removed in spring, lime sulfur be used (as indicated), and that all old fruiting canes be removed as soon as possible after cropping.

The endotrophic mycorrhiza of strawberries and its significance, D. G. O'BRIEN and E. J. M'NAUGHTON (*West of Scot. Agr. Col., Research Bul. 1 (1928), pp. 32, pls. 6*).—This paper presents results of a mycological investigation carried out during 1926 and 1927 on the so-called Lanarkshire disease of strawberries in the Clyde Valley of Scotland. This disease, here defined as root weakness, is characterized by an insufficiency of the fine absorbing rootlets, the other symptoms being largely or wholly the signs of consequent starvation. The only organism constantly present in the living roots of the unhealthy plants is an endotrophic mycorrhizal fungus of the type bearing arbuscules and vesicules, which invades chiefly the fine absorbing roots. These roots are produced in particular abundance about flowering time, and coincidently the organism is at its maximum occurrence and the destruction of the roots is at its height.

Starch and other materials are removed from the root tissues by the action of the arbuscules, without any perceptible return to the depleted cells, the vitality of which is lowered as a consequence. The arbuscules are never completely digested by the host, which thus loses to the fungus. At points where severe infection occurs the finer rootlets are ruptured and drop away.

This endotrophic mycorrhizal fungus is regarded as parasitic and fundamentally causal in this disease, which tends to be slow and chronic in its action but fatal in the case of severe infection. The disease assumes serious proportions under conditions favoring this organism or other organisms which take advantage of the plant's weakness. The root off-fall infects the surrounding soil, which may then spread the disease to the runners, and these may in turn carry it on to other plants.

Disease in strawberries, D. G. O'BRIEN and E. J. M'NAUGHTON (*Scot. Jour. Agr., 11 (1928), No. 3, pp. 286–297, pls. 4*).—This is a summary of the report above noted.

A comparison of the pathogenicity of various strains of Phytophthora faberi Maubl. on cacao pods, etc., in the Gold Coast, H. A. Dade (*Gold Coast Dept. Agr. Bul. 13* (*1928*), *pp. 89–92*).—In the present work, undertaken at the request of S. F. Ashby, who furnished 9 of the 10 strains of *P. faberi* used, information was obtained, tabulated, and detailed for the several strains which is considered to show some definite facts which should assist in the study of affinities of the various parasitic strains of *P. faberi*.

The relation between diseased cushions and the seasonal outbreak of "black pod" disease of cacao, H. A. Dade (*Gold Coast Dept. Agr. Bul. 13* (*1928*), *pp. 85–88, pls. 3*).—In continuation of the report previously noted (E. S. R., 60, p. 245), an account is given regarding the possibility that the cushions may provide the means of overwintering for *Phytophthora faberi*, which is now definitely known as causal in this connection.

It was found that at least the great majority or apparently all of the black pod infection which had occurred early in the season was definitely associated with cushions in which there was deeply seated disease. All stages of infection were seen, these including cases in which it was traveling down the peduncle but had not yet reached the pod. Small blocks of infected tissue, removed from the deeper regions of cushions by means of sterile knives, produced cultures of *P. faberi* on corn meal agar. These cultures were more than usually vigorous, producing a rapid rot of cacao pods within two days after inoculation. No doubt remains, therefore, that *P. faberi* can pass through the harmattan in the cushions. Most or all of the earliest pod infection originates in diseased cushions, and doubtless "this is the principal, as it is certainly the most effective, means of production of the seasonal activity of *P. faberi* as a pod pathogen."

Dissemination of cacao pod diseases by invertebrates, H. A. Dade (*Gold Coast Dept. Agr. Bul. 13* (*1928*), *p. 93*).—A large number of unevenly distributed groups of cases of mealy pod were observed among the trees in a cacao plat in the Aburi agricultural station, and these cases could not be correlated with the usual determining factors. The infection rate ran as high as 68 per cent on some areas. Observations and tests indicated the probable agency of a small snail, also of an ant (probably *Cremastogaster* sp.), and the large though inconspicuous parts which invertebrates are held to play in the transmission of pod diseases.

Effect of sea water on mould in cacao beans, J. L. Scott and W. B. Hudson (*Gold Coast Dept. Agr. Bul. 13* (*1928*), *pp. 62–66*).—It is found that absorption of sea water by cacao is as conducive to molding as that of fresh water, though possibly a different type of mold forms in the case of sea water.

Chlorosis of trees and shrubs (*Idaho Sta. Bul. 164* (*1929*), *p. 10*).—A preliminary account is given of studies on the control of chlorosis in trees by filling with dry salts holes bored into the trunks. Temporary improvement was noted in the iron-treated trees, but the experiments are not considered to have progressed far enough to warrant definite recommendations.

ECONOMIC ZOOLOGY—ENTOMOLOGY

A text-book of zoology, T. J. Parker and W. A. Haswell (*London: Macmillan & Co., 1928, 4. ed., rev., vols. 1, pp. XL+816, figs. 713; 2, pp. XXII+71 figs.* [548]).—The first volume of this new edition of the work previously noted (E. S. R., 48, p. 649) has been revised by W. D. Lang and the second volume C. F. Cooper.

Practical observations on the fox and proven treatises of common ailments (*Ontario Dept. Game and Fisheries Bul. 1 (1928), pp. 30, figs. 2*).—This is a practical account.

The cowbirds: A study in the biology of social parasitism, H. FRIEDMANN (*Springfield, Ill.: Charles C. Thomas, 1929, pp. XVII+421, pls. 29, figs. 13*).—Following a brief discussion of the genera of cowbirds, the author deals at length with two species of Agelaioides, three of Molotbrus, and two of Tangavius. The evolution of the present cowbirds (pp. 343–346) and the origin and evolution of the parasitic habit (pp. 347–356) are then taken up. In an appendix the rice grackle, *Cassidix oryzivora*, is considered (pp. 357–359), and a list is given of the literature cited (pp. 360–395).

The work is a complete report on all the American cowbirds, based on five years of uninterrupted work, three breeding seasons having been spent in central New York State, one in Argentina, and one on the Texan-Mexican border.

Insects and their control, A. WILSON (*New Brunswick, N. J.: Thatcher-Anderson Co., 1929, pp. 342, figs. 184*).—This is a practical handbook on insects and means for their control.

Man's influence on insects, E. O. ESSIG (*Sci. Mo., 28 (1929), No. 6, pp. 499–506, figs. 6*).—A popular discussion of control work with insects.

Agricultural entomology, D. H. ROBINSON and S. G. JARY (*London: Duckworth, 1929, pp. XI+314, figs. 149*).—Part 1 of this work (pp. 1–43) deals with general morphology, physiology, and classification. Part 2 (pp. 45–271) is the economic section. Other Arthropoda of economic importance, eelworms, and snails and slugs are considered in appendixes. A bibliography of 24 titles is included.

Scientific apparatus and laboratory methods: Two common fly species easily reared in the laboratory, J. W. WILSON and N. R. STOLL (*Science, 69 (1929), No. 1796, pp. 577–579, fig. 1*).—The authors have found that two species of the family Borboridae, genus Leptocera, namely, *L. longicosta* and *L. ordinaria*, were readily carried through from generation to generation in milk bottles or shell vials when sheep dung was used as food.

[Report of work in entomology at the Idaho Station] (*Idaho Sta. Bul. 164 (1929), pp. 28–30*).—Brief notes are given on the work of the year (E. S. R., 59, p. 757) with the alfalfa weevil; beet leafhopper; codling moth, a 3-year study of the life cycle of which in southwestern Idaho was completed in 1928; Colorado potato beetle; a destructive prune worm, *Mineola scitulella*, widely distributed, control work with which has proved negative so that the pest now threatens to become the worst enemy of prunes in Idaho; the fruit-tree leaf roller, an average of 95.8 per cent of the eggs of which were killed by the application of 4 per cent oil; onion thrips, which were found to be much more effectively controlled by dusts than sprays; and San Jose scale, for which the application of 3 per cent oil killed 100 per cent in southern Idaho, and lime sulfur at 4 and 5° B. strengths gave entirely satisfactory control.

[Report of the department of entomology] (*Massachusetts Sta. Bul. 247 (1929), pp. 317–319*).—In work with insecticides by H. T. Fernald and A. I. Bourne, miscible oils and lubricating oil emulsion gave satisfactory control against the European red mite, with the soapless emulsions less effective, one of them being sufficiently toxic to cause serious injury.

Reference is made to the development of a compressed air driven power sprayer in control work by Bourne with the onion thrips, studies of which pest have been noted (E. S. R., 55, p. 254). In a study of the spray residue problem by Bourne in its relation to orchard practices it was found in 1927–1928, years with large amounts of rainfall throughout the summer, that Wealthy apple

trees could be sprayed as late as July 15 and McIntosh during all of July, and that Baldwins were under tolerance even when sprayed in mid-August. It appears that in dry seasons or with moderate rainfall present spray practices for later spraying will need modifications.

It was found by W. D. Whitcomb in studies at Waltham that the spraying recommendations based on insect studies at Amherst are generally applicable in eastern Massachusetts. With the apple maggot, however, it was found that during a period of three years the flies did not emerge in sufficient numbers to warrant spraying before July 15, two weeks later than recommended for spraying at Amherst. It was found by Whitcomb that a spray applied three weeks after the calyx spray is more effective in combating the plum curculio and codling moth in apples than hitherto supposed, and that the pink spray has no value against the plum curculio.

Studies of the greenhouse red spider by Whitcomb, a bulletin on which has been previously noted (E. S. R., 60, p. 644), are referred to. Its control by three or more fumigations with naphthalene is reported.

In work with garden cutworms by Whitcomb (E. S. R., 60, p. 165), 73 different kinds have been collected or reared. Screen traps have been used very successfully for collecting them for experimental work, and control tests show that a mixture of 25 lbs. of bran, 1 lb. of Paris green, 1 qt. of cheap molasses, and 2 gal. of water gives effective control. Sodium fluosilicate and white arsenic proved less effective than Paris green. Applications should be repeated at about 10-day intervals to reach cutworms which migrate to the garden from outside.

Brief reference is made to a study of the biology of the carrot rust fly, in the control of the first generation of which very encouraging results have been obtained by the use of asphalt mulch paper, Derris compounds, corrosive sublimate, and sodium fluosilicate. These mixtures, however, proved quite ineffective against the second generation.

[Economic insects and their control in New Jersey] (*N. J. State Hort. Soc. Proc., 1928, pp. 44–54, 54–61, 198–204*).—This report includes accounts of The Primary Insect Problems of the Apple Grower in the Season of 1929 (pp. 44–54), The Intelligent Use of Pyrethrum and Nicotine Sprays and Dusts against Vegetable Insects (pp. 54–57), and The Economic Status of the Mexican Bean Leaf Beetle (pp. 57–61), all by T. J. Headlee; and the Japanese Beetle—Latest Recommendations for Control, by L. B. Smith (pp. 198–204).

[Report of the Entomological Branch of Canada], W. R. MOTHERWELL (*Canada Min. Agr. Rpt. 1927–28, pp. 105–126*).—Brief accounts (E. S. R., 59, p. 352) are given of the occurrence of and work during the year with the more important insect pests.

The Ohio wheat field insect survey for 1929, E. C. COTTON (*Ohio Sta. Bimo. Bul. 140 (1929), pp. 153–155, figs. 2*).—This is a report of the annual survey (E. S. R., 57, p. 859). Samples were taken in 10 wheat fields in each of the 34 counties, 19 of which were included in the survey of the preceding year, the figures shown on an accompanying map being the average percentages of infestation of wheat stems with Hessian fly in the respective counties. With the exception of Butler County, where the year's percentage was double that of last year, the fly population in the wheat fields of the State was at a standstill or had decreased materially.

Injurious and beneficial insects affecting the cranberry, H. J. FRANKLIN (*Massachusetts Sta. Bul. 247 (1929), pp. 313, 314*).—This is a brief discussion of the investigational work of the biennium at the Cranberry Substation.

A study of the disease of the black-headed fireworm by W. H. Sawyer led to the determination of *Entomophthora sphaerosperma* as the cause. It was found that this fungus is absent or inactive on the bogs where fireworm infestations are notably resistant to control, and generally abundant on other infested areas. Bogs on which it is scarce are found generally to be large well-managed areas that have been flooded, sprayed, and resanded regularly. Evidently it is killed out directly or indirectly by late spring or summer flooding, or by sanding or spraying, since no evidence was found that fall flooding or the winter flood, even when it is held late, affects it. Extensive spraying tests with pyrethrum soap have shown that it should have an important place as a treatment for the first brood of the black-headed fireworm and as a control for leafhoppers. It will not, however, take the place of nicotine sulfate for most of the other treatments for which that insecticide is used.

The life history of the holly mite (*Paratetranychus ilicis* McG.) was worked out. It was discovered that heavy rains during its active season sometimes very nearly achieve its complete control. Progress was made in work with improved methods of applying the sodium cyanide solution for the control of the cranberry root grub (*Amphicoma vulpina* Hentz). It was found that the cranberry white grub (*Phyllophaga anxia* Lec.) could be controlled best by the treatment used against the cranberry root grub. The life history of the cranberry black bug, which is often so abundant that it drains the vines seriously, was partially worked out. Considerable attention was paid to the parasites of cranberry pests, several new forms being reared.

Progress report on coffee insect pests: Investigations of the Mobile field station, H. C. James (*Kenya Colony Dept. Agr. Bul. 22 (1928), pp. 9*).—A brief account of several enemies of coffee, including the white borer (*Anthores leuconotus* Pasc.), the yellow borer (*Dirphya princeps* Jord.), the fringed scale (*Asterolecanium coffeae* Newst.), and the citrus mealybug.

Report on insect infestation of dried fruit, J. G. Myers ([*Gt. Brit.*] *Empire Marketing Bd.*, [*Pub.*] *12 (1928), pp. 36*).—Following a brief introduction, part 2 deals with insects concerned and their life history, including the Indian meal-moth, *Ephestia cautella* Walk., *Silvanus surinamensis* L., and other insects and mites (pp. 8–13); part 3 with the possible seats of infestation (pp. 13–20); and part 4 with control measures (pp. 20–30). A bibliography and four appendixes are included.

[Forest insects] (*Indian Forest Rec., 13 (1927), No. 2, pp. 37, pls. 5*).—In part 1 of this work the Identification of Immature Stages of Indian Cerambycidae, II (pp. 1–31), continuing the article previously noted (E. S. R., 55, p. 764), and in part 2 Descriptions of Three Indian Beetle Larvae (Cerabidae Col.) (pp. 33–37) are presented by J. C. M. Gardner.

Biological notes on Scolopendrellidae, destructive to the roots of pineapple in Hawaii, J. F. Illingworth (*Hawaii. Ent. Soc. Proc., 7 (1928), No. 1, pp. 37–41, figs. 3*).—Observations of the Scolopendrellidae, which have been found attacking pineapple roots in Hawaii, are reported upon.

Thysanoptera of the Hawaiian Islands, D. Moulton (*Hawaii. Ent. Soc. Proc., 7 (1928), No. 1, pp. 105–134, figs. 5*).—The author here summarizes records and lists the species of thrips known to occur in the Hawaiian Islands, describing 15 as new to science. The genus Kentronothrips is erected.

The common green capsid bug, F. R. Petherbridge (*Jour. Min. Agr.* [*Gt. Brit.*], *35 (1929), No. 12, pp. 1133–1140, pls. 2, figs. 3*).—This is a practical account of *Lygus pabulinus*, a study of which by the author and Thorpe has been noted (E. S. R., 60, p. 846).

Studies on the morphology of the beet leafhopper, Eutettix tenellus Baker), G. F. Knowlton (*Utah Sta. Bul. 212 (1929), pp. 24, figs. 36*).—This a report of histological and other anatomical studies of the beet leafhopper, esented in connection with a list of 44 references to the literature.

Occurrence of the European walnut aphis in Oregon, B. G. Thompson *Pan-Pacific Ent., 5 (1929), No. 3, p. 122*).—The dusky-veined walnut aphid *Callipterus juglandis* Frisch), not hitherto recorded as occurring in the Unid States, was found by the anthor doing damage to walnuts in the central 'illamette Valley in the summer of 1928.

The status of the sugar cane moth stalkborer in Cuba, H. K. Plank *Planter and Sugar Manfr., 82 (1929), No. 20, p. 382*).—A brief discussion of ıe status of the sugarcane borer in Cuba, where four insect parasites have een noted which at times kill about half of the borers in some plantations.

Notes on the tomato leafminer, Phthorimaea lycopersicella Busck, in Iawaii (Lep.), O. H. Swezey (*Hawaii, Ent. Soc. Proc., 7 (1928), No. 1, pp. 77, 178*).—Notes are presented on the habits of this species, occurring in Caliornia, Mexico, and Hawaii, and is said also to occur in Virginia, Kentucky, Iissouri, Louisiana, Texas, and Colorado. The larvae of this species collected or rearing were found to be parasitized by *Angitia blackburni* (Cam.).

Phthorimaea lycopersicella, new species (family Gelechiidae), a leaf feeder on tomato (Lep.), A. Busck (*Hawaii. Ent. Soc. Proc., 7 (1928), No. 1, pp. 171–176, figs. 7*).—Under the name *P. lycopersicella* the author describes a new species, occurring in California and extending into Sinaloa, Mexico, and which has been accidentally introduced into the Hawaiian Islands. It closely resembles and has been identified in economic literature as *P. glochinella*, which is confined to the eastern and southern parts of the United States, east of the Rocky Mountains.

Studies on the family Zygaenidae of Japan.—I, The life history of Pryeria sinica Moore [trans. title], M. Takai (*Kagami Kenkyu Hôkoku (Research Bul. Gifu Imp. Col. Agr.), No. 3 (1928), pp. 40, pls. 2; Eng. abs., pp. 39, 40*).—This is a report on biological studies of *P. sinica*, conducted principally in the laboratory of the Imperial Gifu Agricultural College near Gifu city. The caterpillar of this lepidopteran feeds on the leaves of *Evonymus japonicus* (Masaki), *E. alatus* (Nishikigi), and *E. europeaeus hamiltonianus* (Mayumi). The feeding experiments show that it can be reared on *E. japonicus radicans*, *E. oxyphyllus*, and *Celastrus articulatus*. Notes on its life history and habits, parasitic enemies, and means of control are included.

Codling moth control in walnuts, D. H. Rundle (*Calif. Cult., 72 (1929), No. 21, pp. 606, 607*).—This is a brief summary of the status of control of this pest on walnuts in California.

The oriental fruit moth in Pennsylvania, J. R. Stear (*Penn. Dept. Agr. Bul. 477 (1929), pp. 13, figs. 8*).—This is a practical summary of information on the oriental fruit moth, which first appeared in numbers in Pennsylvania in 1923 and by 1929 was found throughout the State, except possibly in very isolated orchards.

Low cutting reduces corn borer menace, C. B. Dibble and A. R. Marston (*Michigan Sta. Quart. Bul., 12 (1929), No. 1, pp. 3–5, figs. 2*).—Records of the number of borers per acre remaining in stubble of various heights, including the average for 1926–1928, are reported in tabular form. It was determined that many corn borers occur in corn stubble, that low-cut stubble harbors fewer borers than high stubble, and that borers found below the surface of the ground as well as those in short stubble may be disposed of by clean plowing.

Heat and time of exposure necessary to kill larvae of the European corn borer in ear corn, G. W. Barber (*U. S. Dept. Agr. Circ. 71 (1929), pp. 14, figs. 4*).—This experimental work on the destruction of the European corn borer in ear corn in 1922–1924 was conducted with a view to permitting shipment of seed corn on the cob into uninfested territory for exhibition, etc.

In work with borers unprotected by the cob—in which they most commonly occur—it was found that all larvae were killed in 5 minutes at constant temperatures of 68 and 70° C. (154.4 and 158° F.), and in 6, 7, 9, 11, 13, and 15 minutes at constant temperatures of 64 and 66, 62, 60, 58, 56, and 54°, respectively, whereas lower constant temperatures seemed to be ineffective in killing them.

Detailed studies made of the time necessary to kill larvae at constant temperatures of from 58 to 66° C., found to be most effective in the first tests, resulted in obtaining complete kills at the following constant temperatures with the periods of time specified: At 66° in from 4 to 6 minutes, at 65° in from 4 to 6 minutes, at 64° in from 4 to 7 minutes, at 63° in from 5 to 6 minutes, at 62° in from 5 to 8 minutes, at 61° in from 6 to 7 minutes, at 60° in from 6 to 9 minutes, at 59° in from 5 to 10 minutes, at 58° in from 8 to 10 minutes. These experiments indicated that considerable variation in susceptibility to heat was characteristic of hibernating larvae of this insect, some individuals being killed more readily by a certain degree of heat than are others. In each of the experiments 10 larvae were inclosed in the cheesecloth cage during the test.

In determining the rise of temperature within the center of the cob special chemical thermometers of about the thickness of an overwintering corn borer larva were obtained, and these were fitted into the insect's burrow in the cob without unduly enlarging the hole and so interfered as little as possible with the natural protecting insulation of the cob. The results are presented in detail in chart form, curves showing the rise in temperature within ears of Golden Bantam sweet, Longfellow flint, Brewer Yellow dent, and Queen Golden pop corn when subjected to constant temperatures of 40, 50, 60, and 70° C. Examination of the curves shows that although the temperature within the ears was raised considerably it was still below the constant temperature of the heating chamber after a 2-hour period. A continuation of the heating showed that usually more than 5 hours was necessary to bring the temperature of the center of the cob to the temperature of the heating chamber. The rise of temperature within the cob was quite rapid during the first hour of heating, much slower during the second hour, and thereafter was very slow.

An examination of certain of the factors influencing the rise of temperature within the ear showed that within well-dried ears it rose with considerably greater rapidity than within wet or moist ears. The kernels were found to be important insulating agencies, inasmuch as the temperature in the center of cobs from which the kernels had been removed was raised much more rapidly than the temperature in the center of cobs on which the kernels remained.

Details of the killing point of larvae of the European corn borer determined by heating ears of corn at several constant temperatures for various periods of time are presented in tabular form. Larvae in the ears of any type of thoroughly dried corn were found to be killed at the following temperatures not injurious to the grain at 58° C. in 24 hours, 60° in 8 hours, 63° in 5 hours, 66° in 3 hours, and 68° in 2.5 hours.

Preliminary experiments in heating infested ears of corn so as to kill the contained larvae showed that to do this successfully in the shortest possible time the ears may be placed in single layers on trays the bottoms of which are of

screen wire, such as 1-in.-mesh chicken wire. The trays should be arranged on racks in the heating chamber in such a way as to allow free circulation of air about the ears. The heating period should be measured from the time the container reaches the desired temperature after the ears have been introduced.

"The heating of ears up to 68° C. for the periods of time studied was not found to affect injuriously the subsequent germination of the seed, or the growth of plants, or production of ears from such seed. The moisture content of the ears used was not determined, and for this reason the safety of such temperature may be questionable except in the case of thoroughly dried ear corn."

Clothes moth prevention as adapted to the needs of the housekeeper, H. White, B. B. Fulton, and K. T. Cranor (*Ent. News, 40 (1929), Nos. 4, pp. 117–121; 5, pp. 137–141*).—Experiments on the attractiveness of fabrics and the effectiveness of different methods of moth-proofing with a limited number of larvae are reported. In an experiment made with a view to determining the comparative attractiveness of scoured wool fleece and white wool fabric, 80 per cent of the larvae were found in 2 weeks' time entangled in the wool fibers of the fleece. This is considered to indicate that clothes-moth larvae prefer wool fiber untouched by manufacturing processes.

In tests as to the comparative attractiveness of dyed and undyed wool yarn, the red yarn although attacked was injured only about one-half as much as the white yarn. The results obtained in tests with various weaves of white all-wool fabrics indicate that clothes-moth larvae prefer the hairy, napped, and loosely woven fabrics to the tightly woven hard-finished ones.

A commercially moth-proofed blanket was found equally attractive to the larvae as untreated blanket samples of the same make. A test of the effectiveness of Larvex moth-proofing solution indicated that the solution would on thorough saturation make materials repellent to the moth larvae to such an extent that they would refuse it as food. Tests indicated that Eulan F Extra, a moth-proofing compound, tends to prevent damage by the moths, and that Eulan A is a satisfactory moth-proofing substance. Experiments indicated that sodium silicofluoride has a decided moth-proofing effect on woolens, samples thus treated remaining uninjured at the end of 15 days. Larvae which were placed upon a sample of flannel that had been saturated with Enoz Moth Spray died within a week, but the material had such an oily feeling and the odor was so disagreeable even after 2 months of airing that the solution was considered impracticable for use for moth-proofing.

In an experiment conducted with a view to determining the physical effect of the moth-proofing solutions on various materials, samples of purple felt, black and white checked wool suiting, red wool broadcloth, blue wool crêpe, mohair upholstery material, and white fur were saturated in each of the following solutions: Larvex, Eulan F Extra, Eulan A, sodium silicofluoride, and sodium fluoride. The visible physical characteristics of the wool fabrics were not changed by any of these moth-proofing solutions.

A list of 39 references to the literature is included.

A new avocado moth (Lepidoptera, Fm. Tortricidae), A. Busck (*Calif. Dept. Agr. Mo. Bul., 18 (1929), No. 4, pp. 276, 277, fig. 1*).—Under the name *Amorbia essigana* n. sp. a new moth enemy of the avocado in California is described.

Tobacco cutworms, S. E. Crumb (*U. S. Dept. Agr., Tech. Bul. 88 (1929), pp. 180, pls. 9, figs. 19*).—Under the heading of general consideration of tobacco cutworms, the author takes up the distribution, coloration of larvae, anatomy of larvae, an outline for description of a cutworm, a key to the cutworms which attack tobacco, eggs and first-instar larvae, pupae of tobacco cutworms, breed-

ing methods, seasonal history, and natural control. The species are considered under the headings of the Feltia and Euxoa groups, the genus Polia, the *c-nigrum* group, and the genus Prodenia. The remedial control of cutworms is discussed under the headings of poisons applied to plants, poisoned baits, and other control methods. A list of 84 references to the literature is included.

Notes on the sugar-beet army worm in California, R. E. CAMPBELL and V. DURAN (*Calif. Dept. Agr. Mo. Bul., 18 (1929), No. 4, pp. 267–275, figs. 7*).—This is an account of the beet army worm, which is a pest not only of sugar beets but at times does serious damage to other crops, including peas, cotton, and peppers in California.

Mosquitoes of New Hampshire.—A preliminary report, P. R. LOWRY (*New Hampshire Sta. Bul. 243 (1929), pp. 23, fig. 1*).—Following the introductory part of this bulletin, the author considers the economic importance of mosquitoes under New Hampshire conditions, life history, natural control, and control by oiling, filling, draining, fish, screening, and repellents, and describes the several stages of the mosquitoes. The list of 44 species, of which 38 are known to occur in the State, which follows includes notes on their habits, etc.

Studies on the bionomics of North American anophelines: Physical and chemical factors in their relation to the distribution of larvae in northeastern North Carolina, M. F. BOYD (*Amer. Jour. Hyg., 9 (1929), No. 2, pp. 346–370, figs. 7*).—The data here presented indicate that the temperature and reaction of the water and its content of dissolved oxygen and carbon dioxide are important factors in the determination of the distribution of the breeding places of the local species of Anopheles.

Malaria control through anti-mosquito measures in Italy, L. W. HACKETT (*Roy Soc. Trop. Med. and Hyg. Trans., 22 (1929), No. 6, pp. 477–499, pl. 1, figs. 5*).—The author reports upon the work of the Malaria Experiment Station at Rome, which during the last four years has carried on experiments in malaria control in certain Italian communities using (1) antilarval measures alone, (2) antilarval measures combined with intensive quininization, and (3) intensive quininization alone.

The work of the Anti-Malaria Commission in combating malaria in Egypt (*Egypt Govt. Anti-Malaria Comn. Rpt. 1 (1919–1925), pp. [2]+60, pls. 24*).—This account of the work of the Anti-Malaria Commission in combating malaria in Egypt includes a discussion of the stocking of fish and a mosquito survey.

Water chlorination in combating yellow fever [trans. title], P. BUNAU-VARILLA (*Compt. Rend. Acad. Sci. [Paris], 187 (1928), No. 22, pp. 1005, 1006*).—The author finds the purification of water through the use of 1 gm. of chlorine to 10 cubic meters of water to be a valuable preventive measure, since the yellow fever mosquito is unable to develop in water that does not contain organic matter and microorganisms.

Etiology of Oroya fever.—XIV, The insect vectors of Carrion's disease, H. NOGUCHI, R. C. SHANNON, E. B. TILDEN, and J. R. TYLER (*Jour. Expt. Med., 49 (1929), No. 6, pp. 993–1008, pls. 3*).—The experimental observations here reported (E. S. R., 61, p. 55) have led the authors to conclude that certain phlebotomi act as insect vectors of Oroya fever and verruga peruana. The phlebotomi which have been shown quite certainly to carry the *Bartonella bacilliformis* are those of the species *Phlebotomus noguchii*. *P. verrucarum*, as reported by Townsend in 1913 (E. S. R., 29, p. 856; 30, pp. 252, 658), is also probably a vector, while *P. peruensis* remains doubtful in this respect.

Mediterranean fruit fly invades Florida, M. H. WALKER (*Fla. Grower, 37 (1929), No. 5, pp. 5, 6, figs. 4*).—This account, announcing the discovery on

April 6 of the occurrence of the Mediterranean fruit fly in Florida, refers briefly to the quarantine of the infested area and gives a short account of the fly and an alphabetical list of its host plants.

[Mediterranean fruit fly in Florida] (*Citrus Indus., 10 (1929), No. 5, pp. 5, 6, 8, 9, 21, 28, 29, 33, fig. 1*).—Three contributions are included as follows: Mediterranean Fruit Fly, by J. R. Watson (pp. 5, 21); Mediterranean Fruit Fly Quarantine Effective May 1, 1929: A Digest and Interpretation, by W. M. Scott (pp. 6, 28, 29); and Fighting the Fruit Fly, by P. L. Waycoup (pp. 8, 9, 21, 33).

Fighting the fruit fly: Federal and State forces tackle Herculean task of controlling perilous pest (*Fla. Grower, 37 (1929), No. 6, pp. 5, 6, fig. 1*).—This is a discussion of the eradication work under way in Florida.

Determining the effects of change in temperature upon the locomotor movements of fly larvae, D. F. Miller (*Jour. Expt. Zool., 52 (1929), No. 2, pp. 293–313, figs. 11*).—In studies conducted with larvae of *Lucilia sericata* Meig., in which temperature changes were controlled and measured, it was found that the rate of locomotion varied directly as the temperature from the low limit of activity, about 2° C., to about 40°, and inversely above this point. The rate of contraction increased directly with temperature from 0° to 45°. The number of contraction waves made by a maggot in traveling a given distance, as 10 cm., was a constant between the temperatures of 10° and about 33°, which means that the height of contraction of the maggot is the same within this range. Above this temperature optimum and below it the height of contraction decreased. This caused the rate of locomotion to increase up to a point where the loss of height of contraction was greater than the gain from increase of rate of contraction.

Community shade tree spraying for protection from the Japanese beetle, V. I. Safro (*N. J. Dept. Agr. Circ. 156 (1929), pp. 33, figs. 17*).—This is a general discussion of the subject.

The Ostomidae of New Jersey, A. J. Mutchler and H. B. Weiss (*N. J. Dept. Agr. Circ. 154 (1929), pp. 17, figs. 20*).—This is an account of the coleopterous family Ostomidae, the larvae of many of which are known to be predacious. Some species are predacious in both adult and larval stages, preying upon small insects that inhabit bark, fungi, etc. A single species appears to be of economic importance in New Jersey, namely, the cadelle (*Tenebrioides mauritanicus*). An account of its injurious activities is presented, together with such facts as are available on other New Jersey species.

Lyctus powder-post beetles, R. C. Fisher (*[Gt. Brit.] Dept. Sci. and Indus. Research, Forest Prod. Research Bul. 2 (1929), pp. VI+46, figs. 29*).—The several parts of this work following the introduction deal with the life history and habits of Lyctus powder-post beetles, timbers attacked by Lyctus, economic importance of powder-post beetles, and control and remedial measures. Notes on Heat Sterilisation of Timber in Relation to Kiln Seasoning are presented by S. T. C. Stillwell (pp. 26–28), and Vessel Size and the Liability of Woods to Lyctus Attack is described by S. H. Clarke (pp. 29–34). The appendixes present experimental notes on *Lyctus brunneus* (pp. 35–40), heat penetration experiments (p. 41), diagnostic features of dust of Lyctidae and Anobiidae (p. 42), and wood-boring insects associated with Lyctus (pp. 43, 44). A bibliography of 37 titles is included.

Palm seed scolytids in Hawaii (Col.), O. H. Swezey (*Hawaii. Ent. Soc. Proc., 7 (1928), No. 1, pp. 185–187*).—The brown scolytid which breeds abundantly in date seeds has been determined as *Coccotrypes dactyliperda* (Fabr.).

Florida longevity records of the cotton boll weevil, E. F. GROSSMAN (*Fla. Ent., 12 (1928), No. 4, pp. 57, 58*).—In this contribution from the Florida Experiment Station the author reports in tabular detail upon the longevity of 5,000 boll weevils captured near Gainesville and placed in a hibernation cage without food on November 2, 1927. In the daily observations of emergence kept from March 1 until August 9, 11.24 per cent emerged. The last weevil to emerge appeared on July 16, after having spent 257 days without food in the hibernation cage.

Control of the cotton boll weevil by insect enemies, E. F. GROSSMAN (*Science, 69 (1929), No. 1787, pp. 361, 362*).—In this contribution from the Florida Experiment Station the author presents data which indicate that a more extensive study of the natural enemies of the boll weevil will show them to be increasingly important as a limiting factor in boll weevil damage.

On the biology of Eulimneria crassifemur Thoms., parasite of the European corn borer [trans. title], A. PAILLOT (*Compt. Rend. Soc. Biol. [Paris], 99 (1928), No. 26, pp. 821, 822; abs. in Rev. Appl. Ent., 16 (1928), Ser. A, No. 12, pp. 653, 654*).—This is a discussion of the cause of the mortality of the eggs and larvae of *E. crassifemur*, parasitic on the European corn borer in France.

On two chalcid parasites of dipterous leaf miners [trans. title], P. VOUKASSOVITCH (*Compt. Rend. Soc. Biol. [Paris], 98 (1928), No. 13, pp. 1150–1152*).—This is an account of *Solenotus viridis* Först. and *Chrysocharis elongatus*, which parasitize the larvae of *Phytomyza syngenesiae* Hardy=*geniculata* Macq. and *P. atricornis* Meig. mining the leaves of Sonchus, and *Agromyza* sp. mining the leaves of alfalfa in the vicinity of Belgrade.

Pseudotelenomus pachycoris n. g. and sp., egg parasite of Pachycoris torridus (Scop.) [trans. title], A. DA COSTA LIMA (*Compt. Rend. Soc. Biol. [Paris], 99 (1928), No. 26, pp. 880–883, figs. 2*).—Under the name *P. pachycoris* n. g. and sp. the author describes a parasite of the eggs of the hemipteran *P. torridus*, occurring in Santa Cruz, Rio de Janeiro, Brazil.

The grapevine sawfly (Hym.: Tenthredinidae), W. R. HORSFALL (*Ent. News, 40 (1929), No. 6, pp. 174–177, pl. 1, figs. 2*).—An account of the grape sawfly, which feeds upon the sweet winter grape *Vitis cinerea* grown in Arkansas as a porch arbor grape. Brief notes on its life history and habits, secured at Fayetteville, Ark., and data on the duration, with descriptions, of its several stages are included.

Lice affecting poultry in Hawaii, J. F. ILLINGWORTH (*Hawaii. Ent. Soc. Proc., 7 (1928), No. 1, pp. 41, 42*).—Notes are presented on nine species of Mallophaga observed in Hawaii.

The occurrence of Bacterium tularense in the wood tick, Dermacentor occidentalis, in California, R. R. PARKER, C. S. BROOKS, and H. MARSH (*Pub. Health Rpts. [U. S.], 44 (1929), No. 22, pp. 1299, 1300*).—The occurrence of an unrecognized pathological condition in cattle heavily tick-infested in San Benito County, Calif., led to studies which resulted in the demonstration of natural tularemia infection in adults of the Pacific coast tick, *D. occidentalis*. The data obtained, while not sufficient to justify any assumption as to what part *B. tularense* might have played in the pathology of the affected cattle, are of interest as further evidence of the wide dissemination of tularemia infection in nature and of the numerous possible avenues for human contact.

Galba bulimoides Lea an intermediate host of Fasciola hepatica in Oregon, J. N. SHAW and B. T. SIMMS (*Science, 69 (1929), No. 1787, p. 357*).—Of five species of Lymnaeidae collected in Oregon, *G. bulimoides* was the only one that was found in every fluke-infested pasture examined. It was found that

one of the five different cercariae, an unarmed type obtained repeatedly from the specimens of *G. bulimoides* collected in an infested pasture, was identical with the cercaria of *F. hepatica*.

ANIMAL PRODUCTION

The nutritive value of pasture grass and meadow aftermath [trans. title], L. K. Lapinskiĭ (Lapinsky) (*Trudy Vologodsk. Moloch. Khoz. Inst.* (*Arb. Milchw. Inst. Wologda*) *Bŭl. 69* (*1928*), *pp. 5–30*).—Digestion studies with sheep were conducted at the Vologda Dairy Institute, Union of Socialistic Soviet Republics, to compare pasture grass and meadow hay dried under natural and artificial conditions. For each type of feed, studies were made with two pairs of sheep fed for 40 days.

The digestibility of the pasture grass was 11 per cent higher than that of hay dried artificially. Meadow grass was 13 per cent more digestible than hay from the same grass dried artificially and also 10 per cent more digestible than pasture grass.

Investigations on the feeding value of flax husks [trans. title], A. N. Orlov (Orloff) (*Trudy Vologodsk. Moloch. Khoz. Inst.* (*Arb. Milchw. Inst. Wologda*) *Bŭl. 70* (*1928*), *pp. 31–45*).—In feeding tests with sheep at the Vologda Dairy Institute, it was found that the starch equivalent of flax husks was higher than that given by Kellner. Flax husks proved to be superior to oat straw, but were not equal in feeding value to oat and rye chaff. Because of the primitive methods of threshing prevalent in the Union of Socialistic Soviet Republics, many impurities, including poisonous weed seeds, are found in the husks and for that reason they must be fed with care.

Observations on the unconsumed feed offered showed that some animals refused one part of the plant and others a different part.

Simplified technique and apparatus for measuring energy requirements of cattle, E. G. Ritzman and F. G. Benedict (*New Hampshire Sta. Bul. 240* (*1929,*) *pp. 30, figs. 14*).—The design of the equipment used and the technic of its operation for measuring the metabolism of animals are described in this bulletin.

Steer feeding investigations [**at the Caldwell Substation**] (*Idaho Sta. Bul. 164* (*1929*), *p. 20*).—Adding grain, corn silage, or both to an alfalfa hay ration increased the finish and the selling price of steers more than enough to pay for the increased cost of gains. Chopping or grinding alfalfa hay (E. S. R., 59, p. 762) reduced the wastage of hay and the amount required per unit of gain and increased the gain and finish of the steers. Ground hay was slightly more efficient than chopped hay for 2-year-old steers. Yearling steers made slightly more economical gains and required less roughage but more grain per unit of gain and a longer feeding period than older steers. No particular advantage was gained by adding corn silage to a barley-alfalfa hay ration for either yearling or 2-year-old steers.

[**Experiments with beef cattle at the Nebraska Station**] (*Nebraska Sta. Rpt.* [*1928*], *pp. 22, 23, 42, 43, 44*).—Results of experiments in continuation of those previously noted (E. S. R., 59, p. 863) are reported.

Fattening cattle.—The 4 lots of yearling steers which had been wintered at the Valentine Substation were fed for 165 days on a ration of shelled corn, alfalfa hay, and silage. In addition lots 1 and 2 received an average of 1.38 lbs. of cottonseed meal and lot 3 1.38 lbs. of linseed meal per head daily. Lot 2 made a gain of 150 lbs. more during the winter season, 61 lbs. less during the pasture season, and 11 lbs. less during the feeding period than lot 1, which received no cottonseed meal during the winter. Lot 2 returned a greater profit at

the same selling price and dressed 1 per cent higher than lot 1. Adding cottonseed meal to the basal ration fed lot 4 resulted in an increased gain of 27 lbs. per head, increased the finish, and decreased the cost of gains, while adding linseed meal resulted in an increased gain of 31 lbs. per head. However, the cost of feed per unit of gain was slightly higher in the case of linseed meal, and the steers so fed returned slightly less profit than those fed cottonseed meal.

[*Feeding beef calves at the Scottsbluff Substation*].—A study of the value of feeds available in this section showed that calves fed beet tops and alfalfa hay made the highest gains at the least cost per unit of gain. Corn silage and cottonseed cake ranked second in rate and cost of gains.

[*Feeding beef cattle at the Valentine Substation*].—The total gains for a winter feeding period and a summer pasture season of 4 lots of 10 calves each were 277 lbs. per head for those fed prairie hay, 382 lbs. for those fed prairie hay and 1 lb. of cottonseed cake, 373 lbs. for those fed prairie hay and 1.5 lbs. of cottonseed cake, and 362 lbs. for those fed mixed hay. This work indicates the value of supplementing the low protein content of prairie hay with legumes or concentrates and the undesirability of overfeeding a protein supplement.

Rations show profit in fattening baby beef, G. A. Branaman and G. A. Brown (*Michigan Sta. Quart. Bul., 12 (1929), No. 1, pp. 11–13*).—Continuing the studies of rations for fattening calves (E. S. R., 60, p. 68), three lots of 5 steer and 5 heifer calves each, averaging approximately 395 lbs. per head, were fed for 195 days. All lots received corn silage and alfalfa hay. In addition lot 1 was fed ground barley, lot 2 shelled corn and linseed meal, and lot 3 shelled corn. The method of getting the calves on a full grain feed was the same as that previously noted. The silage was full fed, and the hay was kept before the calves at all times, as was also a mixture of equal parts of bone meal and salt.

The average daily gains of the respective lots were 1.84, 1.99, and 1.83 lbs. per head. The rate and cost of gain was practically the same in the case of lots 1 and 3, but due to the fact that there was more pork produced in the shelled corn lot the return per steer was higher in this lot. Adding linseed meal to the shelled corn ration increased the rate of gain, also the cost of gain, produced a better finish, and the animals returned a greater profit than when no protein supplement was fed. All the rations, however, proved very satisfactory.

Protein supplements in rations for fattening calves, P. Gerlaugh (*Ohio Sta. Bimo. Bul. 140 (1929), pp. 147–149*).—In this study 5 lots of 20 heifer calves each, averaging approximately 405 lbs. per head, were fed for 119 days on a basal ration of shelled corn, corn silage, and mixed hay. In addition 2 lbs. per head daily of linseed meal, cottonseed meal, and whole soybeans and 1 lb. of linseed meal and cottonseed meal were fed in the respective lots. In the last 2 lots enough corn was added to make the consumption of concentrate feeds the same for all lots.

The average daily gains were 2.07, 1.92, 1.79, 1.91, and 1.91 lbs. per head in the respective lots. A unit of protein from linseed meal was found to be more valuable than a unit of protein from cottonseed meal, since the feed cost for the calves fed the former was cheaper than that for the calves fed the latter. With whole soybeans the calves consumed less feed, attained a poorer finish, and were less valuable than the other lots receiving 2 lbs. of protein supplement. When fed at the rate of 1 lb. per head daily there was little difference between linseed meal and cottonseed meal in rate or cost of gains.

When the calves were subdivided as to weight it was found that 1 lb. of protein was not sufficient for calves weighing less than 400 lbs. at the start of the test, while those weighing over 400 lbs. gained as well on 1 lb. of supple-

ment as they did when fed 2 lbs. Linseed meal caused no digestive disturbances, and the calves on this feed shed their hair 10 days earlier than those on cottonseed meal. Cottonseed meal had a rather constipating effect, and it was difficult to keep the calves fed whole soybeans on feed.

Little difference was apparent in the hogs following the calves in any lot except lot 3. This was probably due to the fact that the calves in this lot consumed less corn than in other lots. The 20 pigs made 1.3 lbs. of gain per bushel of corn fed the calves. Each pig received 0.2 lb. daily of protein supplement but no additional corn.

Lamb feeding investigations (*Idaho Sta. Bul. 164 (1929), pp. 19, 20*).—Continuing these studies at the Aberdeen Substation (E. S. R., 59, p. 764), it was found that recleaned alfalfa seed screenings in limited quantities could profitably be used as part of a basal ration of barley and alfalfa hay. This feed reduced the amount of barley and hay required per unit of gain and also increased the rate of gain. Wet beet pulp made a satisfactory supplement to the basal ration. Cull beans in limited quantities reduced the feed requirements for gains, but were not palatable and had a lower feeding value than barley.

At the Caldwell Substation lambs fed ground hay wasted no appreciable amounts, those fed chopped hay wasted 5.1 per cent, and those on long hay 28.2 per cent. Preparation of the hay reduced the cost of gains due to the lower feed requirements. Chopped hay produced slightly cheaper gains than ground hay, but there was little difference between the two when fed with barley. Corn silage did not prove a profitable supplement to barley and alfalfa hay, since it did not increase the rate of gain nor decrease the feed requirement.

Rations for fattening lambs (*Nebraska Sta. Rpt. [1928], pp. 23, 24*).—Continuing the lamb feeding work (E. S. R., 59, p. 866), 8 lots of 25 head each were fed for 80 days on shelled corn and alfalfa hay. Lots 2 to 8 were fed a supplementary feed of linseed meal, cottonseed meal, corn gluten meal, linseed meal and cottonseed meal equal parts, linseed meal and corn gluten meal equal parts, cottonseed meal and corn gluten meal equal parts, and a combination of the three, respectively. Adding linseed meal to the ration produced an increase of 3.5 lbs. of gain per lamb, resulted in a better finish, and an increase of 45 cts. in the selling price per 100 lbs., and 45 lbs. of the meal saved 51 lbs. of corn and 81 lbs. of alfalfa in the production of 100 lbs of gain. Cottonseed meal increased the average gain per lamb 4.5 lbs., increased the selling price 30 cts. per 100 lbs., and decreased the cost of gains, and 43 lbs. of meal saved 66 lbs. of corn and 103 lbs. of alfalfa. Corn gluten meal increased the average gain 3.75 lbs. per head, reduced the cost of gains, and increased by 55 cts. per 100 lbs. the selling price, and 42.8 lbs. of the meal replaced 73 lbs. of corn and 150 lbs. of alfalfa. No particular advantage was noticeable when a combination of these supplementary feeds was used.

The production of sheep, H. Girard and G. Jannin (*Le Mouton de Rapport. Paris: Libr. Agr. Maison Rustique, 1928, 2. ed., rev., pp. XII+378, figs. 83*).—A practical treatise on the breeding, feeding, and management of sheep, revised and brought up to date (E. S. R., 44, p. 571).

The sheep and wool industry of Australia and New Zealand, H. B. Smith (*Melbourne, Auckland, and London: Whitcombe & Tombs, [1929], 3. ed., rev., pp. XIV+215, pl. 1, figs. 80*).—This is a third edition of this treatise, previously noted (E. S. R., 32, p. 261), revised in conjunction with H. Haile.

The British Goat Society's Year Book for 1929, compiled by T. W. Palmer (*London: Brit. Goat Soc., 1929, pp. 203, pls. 33*).—This is the ninth

yearbook of the British Goat Society, containing many articles of popula interest similar to those previously noted (E. S. R., 56, p. 71).

A new feeding method and standards for fattening young swine, J. M Evvard (*Iowa Sta. Research Bul. 118 (1929), pp. 181–304, figs. 31*).—A nev standard for fattening young swine based on pounds daily of crude protein an fiberless carbohydrate equivalent per unit of live weight is proposed in thi publication. The new standard also emphasizes the full feeding of low fibered high net energy-carrying feeds, the use of adequate mineral mixture, sufficien vitamins, palatability, and a supply of proteins that are nutritively adequate.

Soybeans and soybean oil meal in swine rations, L. A. Weaver (*Missour Sta. Bul. 266 (1929), pp. 20*).—The average results of two experiments with lots of 7 pigs each, averaging approximately 47 lbs. per head, are reported i this bulletin. Each lot was full fed by hand on 0.5 acre of alfalfa pasture. Th check ration was composed of corn and tankage, 16:1; lot 2 received corn an linseed meal, 8:1; lot 3 corn, tankage, and linseed meal, 24:1:1; lot 4 cor and soybeans, 8:1; lot 5 corn, tankage, and soybeans, 24:1:1; lot 6 corn an soybean oil meal, 8:1; lot 7 corn, tankage, and soybean oil meal, 24:1:1; an lot 8 corn and soybeans, 8:1, and minerals.

The average daily gains in the respective lots were 1.23, 1.16, 1.15, 1.1, 1.0 1.18, 1.16, and 1.11 lbs. per head. The results obtained do not indicate that ther was any advantage either in rate or economy of gain in combining the protei supplements. For supplementing corn on alfalfa pasture 1 lb. of tankag proved to be as efficient as 2 lbs. of either linseed meal, soybeans, or soybea meal, while the last two feeds were slightly superior to linseed meal. A min eral mixture composed of equal parts of ground limestone, superphosphate, an salt did not improve a ration of corn and soybeans on alfalfa pasture. In fact the feed required per 100 lbs. of gain was higher when minerals were fed tha when no minerals were fed.

[Experiments with swine at the Nebraska Station] (*Nebraska Sta. Rpt [1928], pp. 25, 26*).—Several experiments in continuation with those previousl reported (E. S. R., 59, p. 866) are noted.

Forage crops for pigs.—Pigs averaging 53 lbs. per head were divided int 5 lots and fed on Sudan grass for 83 days. All lots were self-fed shelled corn In addition lot 1 was self-fed tankage, and lots 2, 3, and 4 were hand-fe tankage at the rate of 0.33, 0.22, and 0.12 lb. per head per day, respectively The average daily gains were 1.45, 1.29, 1.12, 0.97, and 0.65 lbs. per head in th respective lots, showing that the rate of gain was in direct proportion to th amount of tankage consumed. The cost of gains increased as the tankag consumption decreased, except in lot 1, and the amount of corn consume decreased as the tankage allowance decreased, indicating the value of tankag as an appetizer.

Rations for fattening pigs.—In this study 4 lots of 10 92-lb. pigs each wer fed in dry lot for 70 days. All lots received shelled corn. As a supplementar feed lot 1 received tankage; lot 2 tankage and cottonseed meal equal parts lot 3 tankage, linseed meal, and alfalfa meal, 2:1:1; and lot 4 tankage cottonseed meal, and alfalfa meal, 2:1:1. The pigs in lot 2 gained an averag of 0.31 lb. more per head daily and the cost per unit of gain was lower than i lot 1. The supplement used in lot 3 increased the daily gain 0.21 lb. pe head and reduced slightly the cost of gains as compared with straight tank age, while the supplement used in lot 4 increased the average gain 0.22 lb. pe head daily and materially reduced the cost of gains. Substituting alfalf meal for part of the cottonseed meal lowered the average daily gains 0.09 lb per day and increased the cost of gains.

The effect of ultra-violet radiation on blood formation in young pigs, F. P. MATHEWS, L. P. DOYLE, and R. A. WHITING (*Amer. Jour. Physiol., 88 (1929), No. 4, pp. 616–619*).—Continuing their studies at the Indiana Experiment Station (E. S. R., 58, p. 280), the authors confined four young pregnant sows in a well-lighted hog house throughout the gestation period. Beginning approximately 59 days before farrowing, the sows were irradiated with ultra-violet light at a distance of 28 in. for periods gradually increased from 15 to 40 minutes daily. Two sows were treated in this manner until their pigs were 13 days old and the other 2 until the pigs were 38 days old. The pigs farrowed were all irradiated until they were 38 days old. A check group of 6 sows was confined in the same house and fed a ration supplemented with 3 per cent cod-liver oil but was not irradiated. The pigs from 3 of these litters were equally divided and one lot put outdoors twice daily for periods gradually increased from 30 minutes to 2 hours, while all other pigs were confined in the house. Red cell counts and hemoglobin determinations were made on the blood of all pigs, beginning at from 1 to 3 days of age and continuing at from 7 to 10 day intervals to 35 days of age.

These determinations showed that neither the red cell nor the hemoglobin content of the blood of young pigs was increased by irradiation with ultra-violet light.

[**Experiments with poultry at the Idaho Station**] (*Idaho Sta. Bul. 164 (1929), pp. 37–39*).—Continued studies (E. S. R., 59, p. 769) have further demonstrated the value of cod-liver oil, dried alfalfa leaves, and dried lawn clippings as vitamin supplements for increasing egg production, hatchability, and general health. Feeding irradiated wheat exposed to ultra-violet light for 15 minutes daily at a distance of 1 ft. gave a low rate of egg production and a low percentage of hatchability. Birds so fed had a high mortality rate and showed extreme rachitic conditions.

A dolomitic limestone grit containing 53.9 per cent calcium carbonate and 45.7 per cent magnesium carbonate was a poor source of calcium for normal metabolism as compared with oyster shell. Hens on the limestone grit had a lower rate of egg production and lower hatchability and laid more thin shelled eggs than those receiving oyster shell. The keel bones of the birds fed limestone grit were twisted and crooked and the ribs were enlarged and buckled inward at the middle joints, while birds receiving oyster shell were normal in respect to these conditions. When the intake of minerals was limited to 4 per cent of the mash mixture, a more pronounced deformity of the skeleton occurred. In none of the birds, even in advanced stages of deformity, were symptoms of paralysis manifested.

In two successive hatches, the difference in the relative humidity varied 0.1° and the room temperature was 4° higher for the second hatch. In the first incubation a hatch of 50.54 per cent of fertile eggs was obtained with a relative humidity of 34.87 per cent, while a hatch of 65.56 per cent of fertile eggs was obtained with a relative humidity of 37.8 per cent. During the second incubation the poorest hatch in the low range of humidity was 41.9 per cent of the fertile eggs at 21.9 per cent relative humidity, while a hatch of 30 per cent of fertile eggs was the poorest obtained in the high range of humidity at a relative humidity of 54.7 per cent. A mortality of 43.01 per cent occurred during the third week of incubation with the low range of humidity, and a mortality of 34.44 per cent during the same period with the high range of humidity.

[**Poultry experiments at the Nebraska Station**] (*Nebraska Sta. Rpt. [1928], pp. 33, 34, 35*).—Two studies are briefly noted.

Nutrient requirements of growing chicks.—Chicks were found to be able to adapt themselves to a wide variation in the calcium-phosphorus ratio when the ration fed was complete in every other respect, including vitamin D. The tolerated ratio ranged from 1:1 to 1:6.

Based on the results of three studies, it was found that calcium is best utilized when furnished as tricalcium phosphate. Next in the order of utilization of calcium were calcium lactate, calcium carbonate, calcium sulfate, and calcium chloride. Further studies in which equivalent amounts of calcium were added in the forms of tribasic, dibasic, and monobasic calcium phosphate showed after an analysis of the growth curves that the dibasic and monobasic forms were not suitable for growing chicks. The hypothesis is advanced that the addition of these forms seriously disturbed the acid base.

Turkey production.—Continuing this study (E. S. R., 59, p. 870), it was found that under the most favorable humidity conditions turkey eggs lost 12.4 per cent of their initial weight from the first to the twenty-fourth day of artificial incubation. Weight losses were slightly less in eggs incubated under hens, even when moisture pans were used throughout the hatch in incubators.

Turkey poults on a basal ration low in vitamin B weighed only 449 gm. each at 8 weeks of age, while similar poults receiving 3 per cent of yeast in addition to the basal ration weighed 676 gm. This work indicated a relatively high vitamin B requirement for turkey poults.

Observations on turkey hens have indicated as great a variation in egg production as has been noted with chicken hens.

Simple or complex chick rations, F. E. Mussehl, R. Hill, and C. W. Ackerson (*Poultry Sci., 8 (1929), No. 4, pp. 198–200, fig. 1*).—To determine the value of simple and complex rations for chicks, duplicate studies were conducted at the Nebraska Experiment Station with 87 Leghorn chicks per lot in one study and 262 heavy breed chicks per lot in the second. The all-mash method of feeding was followed, and green alfalfa was fed twice daily. The simple ration consisted of yellow corn meal 43.5, shorts 22, bran 22, and meat and bone scraps 12.5 per cent. The complex ration was made up of yellow corn meal 44, shorts 25, bran 10, meat and bone scraps 10, cottonseed meal 2.5, dried buttermilk 2.5, alfalfa meal 5, and salt 1 per cent. The first ration contained 19.56 per cent and the second 19.25 per cent of protein.

There was no appreciable difference in the growth produced by the two rations, nor were any cases of nutritional disturbance observed. It was found that growing chicks could tolerate a protein plane of 19.5 per cent during the first 8 weeks when the ration was complete for necessary minerals and vitamins.

***The effects of dried shrimps and fish meal as supplements in rations for* egg production,** F. M. Fronda (*Philippine Agr., 18 (1929), No. 1, pp. 3–12, figs. 2*).—In this study at the University of the Philippines, five lots of 20 pullets each were fed for one year on a basal ration composed of one part of a grain mixture of corn and palay and one part of a mash mixture of rice bran, corn meal, and copra meal. Two of these lots had their basal ration supplemented with 5 and 10 per cent, respectively, of dried shrimp, and two others with 5 and 10 per cent of fish meal.

The feed consumption was practically the same in all lots. When fed at the rate of 5 per cent both dried shrimp and fish meal were quite satisfactory and caused a profitable increase in egg production as compared with the check lot. Adding 10 per cent of these supplements further stimulated egg production, but not in proportion to the increased cost of the ration. The yearling hens which had received one or the other of these supplements during their pullet year were well grown and vigorous. The addition of the protein supplement to the basal ration lowered the mortality rate.

A study of certain normal characteristics of White Leghorn females, H. ATWOOD (*West Virginia Sta. Bul. 220* (*1928*), *pp. 16, figs. 3*).—This bulletin, previously abstracted (E. S. R., 61, p. 165) from a copy bearing the name of no author, has also been issued under the authorship here given.

Shall the layers be confined? D. C. KENNARD (*Ohio Sta. Bimo. Bul. 140* (*1929*), *pp. 156–160*).—In a study of the advisability of confining laying birds (E. S. R., 61, p. 667), 3 lots of 100 pullets each were placed under the same system of feeding, housing, and management, except for confinement, for a period of 10 months beginning October 1. Lot 1 had free access to bluegrass range throughout the test. Lot 2 had access to a wire screen sun porch but no range, while lot 3 was confined indoors at all times. In the last lot the windows were opened to admit direct sunlight whenever the weather permitted.

The average production for the 10 months was 122, 127, and 132 eggs in the respective lots, and the mortality rate was 49, 36, and 47 per cent. The feed consumption appeared to be in direct proportion to the egg production. It is concluded from these results that good bluegrass range does not benefit the birds to any appreciable extent.

The relation of antecedent egg production to the sex ratio, E. W. CALLENBACH (*Poultry Sci.*, *8* (*1929*), *No. 4, pp. 230–234*).—This is a report of 1 year's work at the Pennsylvania Experiment Station, in which 3 groups of birds were used. Group 1 consisted of 3 pens of White Leghorns from 1 to 7 years of age, each pen being mated with a single male; group 2, 3 pens of Plymouth Rocks from 1 to 4 years of age, each pen mated with a single male; and group 3, 4 pens of White Leghorn pullets, each pen mated with 4 males. From the first 2 groups 6 hatches at 7-day intervals were run, while only 1 hatch was run from the third group. Only those chicks placed in brooding quarters were considered, and the sex ratio was determined as the proportion of male chicks to total chicks of both sexes.

The mean antecedent egg production was 23, 25.7, and 106.6 eggs in the respective groups, while the sex ratio of chicks brooded was 48.4, 53.88, and 48.51 per cent, respectively. Further work with 3,597 White Leghorn chicks and 1,637 Plymouth Rock chicks gave sex ratios of 47.77 and 50.68 per cent, respectively. These results show no relationship between antecedent egg production and the sex ratio of chicks placed in brooding quarters.

Individuality as affecting points of egg quality, C. S. PLATT (*Poultry Sci.*, *8* (*1929*), *No. 4, pp. 189–192*).—At the New Jersey Experiment Stations, 17 normal healthy birds were selected at 6 months of age and confined in the laying house during the entire year. They were fed a scratch ration of equal parts of cracked corn and wheat and a mash of equal parts of corn meal, wheat bran, pinhead oats, red dog flour, and meat scraps. A moist mash consisting of equal parts of corn meal, rolled oats, and semisolid buttermilk, to which was added cod-liver oil at the rate of 1 per cent of the entire ration, was fed daily. Green alfalfa during the summer and sprouted oats during the winter were fed at the rate of 4 lbs. per 100 birds, and a mineral mixture was before them at all times.

The eggs were graded according to weight as "extras" 23 oz. or more per dozen, "mediums" 21 and 22 oz. per dozen, and "pullets" under 21 oz. per dozen. After weighing, the eggs were candled for shell texture, graded as good and poor, and for firmness of white, graded as firm and watery.

Under the conditions of this study a great variation was observed in the differences of eggs produced by individuals. One bird produced 18 per cent of extras during the year, while another produced 95 per cent. The extent of variation in shell texture and condition of the white was not so large

as the variations in egg weight, ranging from 27 to 96 per cent in the former case and from 20 to 80 per cent in the latter case.

Further studies on factors influencing the weight of eggs, H. Atwood and T. Clark (*Poultry Sci., 8 (1929), No. 4, pp. 193–197, fig. 1*).—To show the relationship between egg production and egg weight (E. S. R., 55, p. 568) when a physiological disturbance is caused by a drug, 1 gm. of kamala was given to each bird in a flock of 165 White Leghorns in their third laying year at the West Virginia Experiment Station. The birds were dosed on the morning of July 1 before they were off the roosts.

Egg production was not materially affected until the third day after dosing, but the mean egg weight decreased from the second day and continued to the ninth day, after which time the weight gradually became normal. The average weight of eggs of birds which began to lay the latter part of the month was less than the average weight of eggs laid by the same birds before laying ceased. The drug also caused a partial molt, bringing production below normal for the month. It is suggested that the yolks of the eggs laid the second day must have been fully formed, but it is assumed that the effect of the drug was to lessen materially the secretion of albumin and possibly to a slight extent the secretion of the shell.

The coefficient of correlation between production and weight for the period from June 15 to July 15 was $r=+0.65\pm0.07$, but there was no significant correlation for the month of July, neither was there any significant difference between the deviations obtained for June and for July.

This work shows that kamala should not be fed to birds in full production, due to the undesirable physiological effects that may result.

Studies in hatchability.—II, Hatchability in relation to the consanguinity of the breeding stock, M. A. Jull (*Poultry Sci., 8 (1929), No. 4, pp. 219–229*).—Continuing these studies (E. S. R., 61, p. 64), an analysis was made of the hatching results of 515 individual matings from each of which 10 or more fertile eggs were secured. The hatching period was from March 17 to the end of April for the years 1925 to 1928, inclusive. A total of 12,547 fertile eggs were incubated, representing matings between full brothers and sisters and half brothers and sisters of the Barred Plymouth Rock, Buff and White Plymouth Rock, Partridge and Silver Penciled Plymouth Rock, and Single Comb White Leghorn breeds.

A hatching percentage of 60.88 was obtained for the fertile eggs set. The embryo mortality was 10.31 per cent from the first to the seventeenth day, inclusive, and 28.81 per cent from the eighteenth to the twenty-first day, inclusive. Such close matings decreased the hatchability by increasing the embryo mortality, especially during the period from the eighteenth to the twenty-first day. Hatchability was more affected during the first year of inbreeding than during successive years, but there was a general decline in hatchability each year that close inbreeding was practiced.

Relation of the preen gland (glandula uropygialis) of birds to rickets, H. C. Hou (*Chinese Jour. Physiol., 3 (1929), No. 2, pp. 171–182, figs. 11*).—In a study at McGill University, Canada, 5 chickens, 7 ducks, and 24 pigeons, some with the oil glands removed and some with the glands intact, were kept under observation in the laboratory for from 6 to 8 months and later for a period of 3 months in open-air inclosures. It was found that the removal of the preen gland of the fowl and duck produced a marked disturbance of the plumage and also impaired the general health. With pigeons, however, only a slight disturbance of the plumage was observed. When the gland was removed from young fowls, either normal or rachitic at the time of removal, a rachitic condition was produced which was not improved by subsequent optimum feeding or

by sunlight. Closing the opening of the gland of ducks brought about a slight disturbance of plumage and a loss of body weight.

A discussion of the possible relationship between the sebaceous secretion and the formation of the antirachitic vitamin is included.

Ultra-violet wave lengths valuable in the cure of rickets in chickens, G. H. MAUGHAN (*Amer. Jour. Physiol., 87 (1928), No. 2, pp. 381–398, figs. 4*).—By using glass filters capable of absorbing different quantities of the shorter ultra-violet light, the author treated 10 groups of approximately 10 rachitic chicks each with varying wave lengths. It was found that the range of effectiveness in curing rickets lay between 3,130 and 2,650 a. u. Below 2,896 a. u. the light was relatively weak in its curative effect, and the 3,130 a. u. length apparently had no beneficial effect. The results showed rather conclusively that wave lengths 2,968 a. u. were the most potent, and that wave lengths 3,024 a. u. were about one-fourth as effective in the cure of rickets.

Appended is a discussion by C. V. Shapiro of the method of determining the transmissive power of the glass filters used in this work.

Fifty years with poultry, N. C. WESTERFIELD (*San Francisco, Calif.: Bruce Brough Press, 1929, pp. XIX+180, figs. 20*).—A practical treatise on the breeding, feeding, and management of poultry.

A dictionary of poultry, D. F. SUTTIE (*London & Glasgow: Blackie & Son, 1929, pp. VII+280, pls. [8], figs. 35*).—This treatise deals in encyclopedic form with all phases of the poultry industry.

DAIRY FARMING—DAIRYING

[Experiments with dairy cattle at the Idaho Station] (*Idaho Sta. Bul. 164 (1929), pp. 26, 27*).—Difficulties were encountered in changing a group of 4 calves from sweet milk to semisolid buttermilk, and the calves were not as thrifty as those fed skim milk. The calves scoured frequently until the time they began to consume large amounts of hay and grain. The gain per calf to 6 months of age was 16.3 lbs. above the Eckles standard, but due to the high cost, semisolid buttermilk was not an economical substitute for skim milk.

Calves fed skim milk and alfalfa hay were thinner in flesh, had longer hair coats, and lacked somewhat in freshness as compared with calves fed skim milk, alfalfa hay, and ground barley. The former ration was more economical up to 6 months of age than the latter, but the calves in both groups were quite satisfactory.

A group of heifers wintered on alfalfa hay alone did not make normal growth as indicated by the Eckles standard. A second group wintered on barley and alfalfa made normal growth in height and more than normal growth in weight, while a third group on alfalfa hay and silage made more than normal growth in both height and weight. The feed cost for 182 days was least with the first and highest with the last ration.

Raw potatoes were found to be a satisfactory feed from the standpoint of palatability, milk production, and maintenance of body weight.

Cows milked twice daily had a production of 60 per cent, those milked 3 times daily 75 per cent, and those milked 4 times daily 100 per cent. For the first group of cows the peak of production was reached before the end of the third week after calving, while those milked 3 and 4 times daily did not reach this peak until the end of the sixth week. Maximum production was reached at about 7 years of age. The milk records of 2-year-olds were found reliable as measures for culling.

A second year's results (E. S. R., 59, p. 772) further emphasize the value of irrigation and the lack of benefit derived from the cultivation of pastures for dairy cows. The addition of manure increased the carrying capacity and the total income per acre.

A study of growth in dairy cattle (*Nebraska Sta. Rpt. [1928], pp. 12, 13*).—A study of the weekly weights and measurements of calves from birth to 26 weeks of age was made with the different breeds of dairy cattle. It was found that Holstein heifer calves gained at the rate of 1.57 lbs. per day to 26 weeks of age, while Holstein bull calves gained 1.74 lbs. per day. Jersey heifer calves gained 1.15 lbs. and Jersey bull calves 1.25 lbs. per head per day.

Milk substitutes in the growing of young calves, J. B. LINDSEY and J. G. ARCHIBALD (*Massachusetts Sta. Bul. 247 (1929), pp. 329, 330*).—Continuing these studies (E. S. R., 59, p. 571), the allowance of skim milk powder fed to the calves was cut from 31.5 to 21 oz. at 2 months of age and to 10.5 oz. at 3 months of age. Special efforts were made to get the animals to eat a dry grain mixture and hay. This system of feeding seems to be the best substitute for liquid skim milk for raising young calves. Buttermilk powder produced almost the same rate of gain as skim milk powder. It was more economical but not as palatable when first fed as the skim milk powder, and in some cases had a decided laxative effect.

An investigation into the methods of handling market milk with the special object of reducing the equipment necessary, M. VAUGH (*Jour. Cent. Bur. Anim. Husb. and Dairying, India, 2 (1929), No. 4, pp. 154–162*).—In this article the author points out the requirements that must be fulfilled in order to produce a milk supply under tropical conditions that is adequate in amount and which can be handled in the raw state without spoilage. Since the capital for investment in dairy equipment in India is small, the object of this study was to reduce to a minimum the necessary equipment.

Metals in dairy equipment.—Corrosion caused by washing powders, chemical sterilizers, and refrigerating brines, O. F. HUNZIKER, W. A. CORDES, and B. H. NISSEN (*Jour. Dairy Sci., 12 (1929), No. 3, pp. 252–284, figs. 2*).—In this study the authors exposed the metals used in work previously noted (E. S. R., 61, p. 563) to various dairy cleansers, to chemical sterilizers, to neutralizing lime, to refrigerating brines, and to successive treatment with steam, cooling water, and brine. A strip of metal 4 in. long was placed in a jar with enough liquid to cover one-half of its length. In the case of washing powders, the metal strips were exposed to their action for 5 hours at 150° F., for chemical sterilizers 5 days at 70°, and for brines 10 days at about 32°. A special experiment was also conducted in which the strips of metal were steamed for 2 hours, held in cold water for 2 hours, then in cold brine for 2 hours, and placed in open bottles overnight. This process was repeated for seven consecutive days. Before exposing the metal strips to any solutions they were washed in a dilute solution of trisodium phosphate, rinsed in water, wiped dry, dried in an oven, and carefully weighed. At the end of the exposure this process was repeated. Observations were also made of the visible corrosion on the strips and the appearance of the liquid.

Aluminum products corroded more than other metals in the washing solutions, the weight losses of three aluminum products accounting for more than two-thirds of the total weight losses of all metals. Tinned copper and tinned iron were also corroded, but their resistance was greater than in the case of aluminum. Of the remaining metals none showed any appreciable weight losses, but nickel silver tarnished to a marked extent in some solutions, and copper, iron, galvanized iron, and zinc corroded to some extent. The corrosion of aluminum

products in alkali washing solutions was avoided by treating sodium carbonate with small amounts of silicate of soda, while the corrosion of tin-plated copper and iron was reduced to a negligible amount by chromate treatment of trisodium phosphate.

Of the three chemical sterilizers used, the sodium hypochlorite was the most corrosive. Because of its alkaline properties, Diversol was destructive to aluminum but was the least corrosive to the other metals. On the tinned products chloramine-T showed less intense action than sodium hypochlorite, but had a more corrosive effect than Diversol. Allegheny metal and Enduro showed no visible corrosion in any of the above sterilizers, and Ascoloy, nickel, Monel metal, and nickel silver were attacked but slightly. Neutralizing lime was particularly severe on aluminum products, and zinc and galvanized iron were also corroded and lost weight. The effect on other metals was slight.

Nickel and Allegheny metal were practically immune to the corrosive effect of either neutral sodium chloride brine or neutral calcium chloride brine, while Enduro, Ascoloy, Monel metal, nickel silver, and tin showed but slight attacks. Copper and tinned products, particularly the latter, showed considerable corrosion in brine. In alkaline brines aluminum products showed marked corrosion, but in other brines little or no effect was noticeable. Weight losses and much corrosion were found with iron, galvanized iron, and zinc in all brines. It was found in general that sodium brines were more destructive than calcium brines, that chromate treatment retarded corrosive action, and that with some metals, particularly aluminum, tin, and zinc products, an alkalinity of 0.05 per cent intensified corrosion.

The quinhydrone electrode in the dairy laboratory, K. E. WRIGHT (*Massachusetts Sta. Bul. 247 (1929), p. 316*).—The quinhydrone electrode determination of pH has not proved practical in determining the keeping qualities of milk. The results so far obtained do not show that the pH of milk is indicative of its keeping qualities.

Electropure process reduces bacteria in milk, E. D. DEVEREUX (*Michigan Sta. Quart. Bul., 12 (1929), No. 1, pp. 20–22*).—This process for reducing bacteria in milk consists of passing the milk through a preheater where it is warmed to about 120° F. The milk then is pumped to the Electropure machine where it passes through a vertical chamber 3.5 by 4 by 24 in. The 4-in. walls are made up of carbon electrodes and the 3.5-in. walls of insulating material. As the milk passes through it is subjected to an alternating electric current of 220 volts. The resistance offered by the various electrolytes in solution in the milk immediately causes the liberation of enough heat to reduce by approximately 99 per cent the bacterial plate count of the milk. This process does not alter the taste or creaming ability of the milk.

In experimental work a temperature of 160° has been found very efficient, and this temperature has been reached when the milk has traveled about two-thirds of the distance, being exposed for only 15 to 20 seconds to the temperature.

Milk inoculated with spore-forming organisms, including the anthrax bacillus, has been passed through the machine with a reduction in different trials of from 71.5 to 99.9 per cent of the spores. In comparison, tubes containing the same milk treated in a manner similar to steam sterilization showed a reduction in the spore organisms of from 0 to 13 per cent.

The ability of Escherichia coli and Serratia marcescens to survive 62.8° C. for thirty minutes in milk, F. W. TANNER and M. F. WINDSOR (*Jour. Dairy Sci., 12 (1929), No. 3, pp. 202–210*).—This study at the University of Illinois was made to determine the possibility of using *E.* (*Bacterium*) *coli* as an indicator of efficient pasteurization. Experiments were made with 23 cultures

of *E. coli* and 8 strains of *Serratia marcescens* (*Bacillus prodigiosus*) in a delicately controlled oil bath, using both sealed tubes and open containers, to determine the ability of the organisms to withstand heat. Only one of the strains of *E. coli* was found to survive repeated heating for 30 minutes at 62.8° C. in sealed tubes, and this strain survived only 21 and 30 minutes in open containers. Four cultures that in one or more tests withstood 30 minutes' heating had been isolated from feces or from water condemned for drinking purposes. All the strains from sewage and commercially pasteurized milk failed to survive heating for 15 minutes. Of the *S. marcescens* cultures none survived more than 9 minutes of heating by any method.

The results indicate that there is always a possibility of encountering resistant strains or cultures of *E. coli* in pasteurized milk, but that on the other hand it is probably impossible to secure an organism that will fulfill all the requirements as an indicator of efficient pasteurization.

Many factors cause abnormal milk flavors, P. S. Lucas (*Michigan Sta. Quart. Bul., 12 (1929), No. 1, pp. 18–20*).—In this article the author discusses the factors that cause abnormal flavors in milk.

Some factors affecting the fat clumping produced in milk and cream mixtures when homogenized, F. J. Doan (*Jour. Dairy Sci., 12 (1929), No. 3, pp. 211–230, figs. 5*).—Continuing the studies of the homogenizing process at the Pennsylvania Experiment Station (E. S. R., 60, p. 368), it is pointed out that homogenized mixtures prepared from cream standardized with milk or skim milk are stable emulsions whether fat clumping is present or absent, but that when diluted with fluid skim milk or whole milk will cream to a marked degree if fat clumps are present. Increasing the fat content and the pressure of homogenization greatly stimulates the clumping of small fat globules in homogenized mixtures of normal milk.

While changes in the acidity of the plasma exert but little influence on the fat-clumping tendencies, heated plasma has an inhibiting effect on the production of fat clumps by the homogenizer. The ratio of plasma solids to the amount of fat in the processed mixtures is a limiting factor in fat clumping. A definite value for a critical ratio above which no clumping is obtained is difficult to determine, due to factors that are in most cases uncontrollable. However, this ratio appears to lie between 0.6 and 0.85 for mixtures made from raw products warmed at 38° C., homogenized at 3,500 lbs. pressure, and of fat concentrations from 8 to 18 per cent. For 4 per cent fat mixtures similarly treated the critical ratio appears to lie between 0.4 and 0.5.

The work indicates that while the explanation of fat clumping is based on more than one effect, the interfacial tension effect seems to best explain the tendency.

Composition and body of butter, E. S. Guthrie (*New York Cornell Sta. Bul. 477 (1929), pp. 34, figs. 11*).—In a study of the variations in the composition of butter, it was found that duplicate analyses of samples did not check closely, so that it became necessary to subject the method of analysis to closer examination. It was found that, by placing an approximate amount of 10 gm. of butter in an aluminum cup and covering immediately with a metal disk similar to a watch glass before weighing, more accurate results were obtained than when exactly 10 gm. was weighed out in an open dish. The modified Kohman method (E. S. R., 40, p. 311) required less time and was fully as accurate as the Official method.

In this work it was demonstrated that thoroughly worked butter had a more uniform composition, shrank less, kept as well, contained somewhat more air, and was as satisfactory a product as medium-worked butter. The author recommends that, because of the variations in the sampling and analyzing of

butter, average creameries should maintain a standard of not less than 81.5 per cent of fat and not more than 15 per cent of water.

Addition of skim milk powder, gelatin, and agar to Cheddar cheese (*Idaho Sta. Bul. 164* (*1929*), *p.* 27).—Adding agar or gelatin to the milk intended for Cheddar cheese had no beneficial effect upon the yield or quality of the resulting cheese. Standardizing milk from 9.5 to 10 per cent of serum solids by adding skim milk powder slightly decreased the flavor score and had no effect on the body or texture score, but did increase the yield of cheese.

A study of the principles of ice cream making (*Nebraska Sta. Rpt.* [*1928*], *p. 12*).—Continuing this study (E. S. R., 57, p. 572), it was found that crystallization of sugar at the surface of frozen sherbet could be prevented by sealing the container and that parchment covers alone were better than leaving the surface exposed. Using large amounts of sugar caused quicker and deeper crustation, but the use of invert and corn sugar as part of the sweetening material retarded and in some cases prevented crystallization. As stabilizers gum tragacanth and gum arabic were not satisfactory, due to the objectionable flavor imparted to the mix.

A study of several processes that have been recommended for determining the fat content of ice cream showed that no one method is satisfactory for all samples.

A device for reducing an ice cream mix to its basic viscosity, R. Whitaker (*Jour. Dairy Sci.*, *12* (*1929*), *No. 3*, *pp. 285–287*, *fig. 1*).—In this article from the New York Cornell Experiment Station the author describes an apparatus for determining the basic viscosity of an ice cream mix and the factors that influence the efficiency of the device.

Enzyme activity of ice-cream improvers, P. H. Tracy and H. A. Ruehe (*Illinois Sta. Bul. 333* (*1929*), *pp. 481–508*, *figs. 7*).—Concluding the study of commercial ice cream improvers (E. S. R., 56, p. 376), it was found that of the 12 improvers studied 11 contained either pepsin or rennet or both, 4 contained starch, 11 sugar, and 7 gum. Thus, the ripening activity of most improvers was dependent upon either rennet or pepsin. In tests upon the time required to coagulate milk, the improvers showed a wide variation in their enzymic strength. The bacterial count was relatively low for all the improvers. Sodium bicarbonate inhibited the action of rennet in milk, but calcium salts hastened its action.

When either rennet, pepsin, or an improver containing these substances was added to milk pasteurized at 145° F. for 30 minutes, it coagulated. On the other hand, milk heated to high temperatures under pressure did not coagulate unless a small amount of calcium chloride was added. When the improvers contained enzymes in powder form, their activities were reduced but not entirely destroyed by temperatures of 100° C. for at least 45 hours. Storing ice cream for 11 weeks in a hardening room did not destroy the activities of the enzymes in rennet, pepsin, or the improvers, and in one case they remained active after 5 months of such storage. Improvers containing enzymes were added to ice cream mixes before pasteurization without causing coagulation if an excessive amount of enzyme was not used. The action of improvers added in this manner was stimulated by increased acidity and serum solids, by the presence of gums or gelatin, and by the slow heating of the mix during the pasteurizing process.

VETERINARY MEDICINE

[Report of work with animal diseases at the Nebraska Station] (*Nebraska Sta. Rpt.* [*1928*], *pp. 10–12*).—Brief reference is made to an inquiry as to the part played by avian tuberculosis infection in farm animals and in man, the results of which are reported in tabular form; likewise to horse disease inves

tigations, particularly with species of Senecio as an etiological factor, a detailed report of which has been noted (E. S. R., 61, p. 768).

[Work with diseases of livestock and their control] (*Vet. Lab., Nishigahara, Tokyo, Ann. Rpt. 1926, App., pp. 1-111, pls. 10, figs. 7*).—The contributions here presented are as follows: On the Disinfection of Anthrax-Spores with Chloride of Lime (pp. 1–13) and On the Disinfecting Power of Acids (pp. 15–17), both by A. Iizuka; Contributions to Biological Studies on the Virus of Contagious Pleuro-pneumonia in Cattle (pp. 19–34), On the Presence of the Virus in the Circulating Blood and Internal Organs of the Cattle Affected with Contagious Pleuro-pneumonia (pp. 35–43), and On the Practical Value of Several Serological Reactions for the Diagnosis of Contagious Pleuro-pneumonia in Cattle (pp. 45–70), all by N. Nakamura, H. Futamura, and T. Watanuki; On the *Trichophyton faviform album* in Calves, by H. Oguni and W. Hashiguchi (pp. 71, 72); An Experimental Study on the Virus of Fowl-Pest.—I, On the Susceptibility of the Pigeon, by N. Nakamura and Y. Kawamura (pp. 73–87); Pathogenicity of Three Types of *B. tuberculosis* to Swine, by K. Otsuka (pp. 89, 90); A Contribution to the Study on Heterogeneous Antigen and Antibody, by Y. Terakado (pp. 91, 92); On the Antigen for Complement Fixation Test in Contagious Pleuro-pneumonia in Cattle, by H. Futamura and T. Watanuki (pp. 93–108); and Contribntion to the Pathologic-Anatomical Study on Contagious Pleuro-pneumonia in Cattle, by H. Morita and T. Higashi (pp. 109–111).

Live stock diseases report, No. 4, M. Henry (*N. S. Wales Dept. Agr., Sci. Bul. 34 (1929), pp. 24, fig. 1*).—This is a summary of information on the occurrence of and work during the year with the more important diseases of livestock (E. S. R., 60, p. 475).

The diagnosis and treatment of tropical diseases, E. R. Stitt (*Philadelphia: P. Blakiston's Son & Co., 1929, 5. ed., rev., pp. XIX+918, pl. 1, figs. 249*).—This work deals with the subject in eight sections and an appendix. In addition to insect-transmitted diseases, etc., animal parasites, including helminths, injurious arthropods, fish, snakes, etc., are dealt with. Chapters are also devoted to tularemia (pp. 274–285), melioidosis (pp. 286–288), and undulant fever (pp. 289–306), and other diseases transmissible from the lower animals to man.

The production of sterile anthrax antigens, S. J. Schilling (*Arkansas Sta. Bul. 238 (1929), pp. 27*).—This bulletin reports experimental work on the preparation of substances capable of inducing protection against anthrax and which are free from living organisms. It deals with the reaction of rabbits treated with virnlent *Bacillus anthracis* sealed in porcelain and celloidin capsules—and with the producing of sterile anthrax antigen in vitro.

The rabbits that were also treated by intraperitoneal implantation of *B. anthracis* in unglazed porcelain capsules were found to become immune to the disease. The production by *B. anthracis* of antigen capable of stimulating animals to produce antibodies without actual contact with animal cells or tissues is thus considered to be established.

"Rabbits were also treated by intraperitoneal implantation of celloidin capsules containing *B. anthracis*. Such animals were found not to become immunized, rather, a state of sensitization was induced in which, upon later exposure to infection by anthrax bacilli, the animals succumbed to typical anthrax and showed a marked increase in the amounts of ascitic exudate encountered at necropsy. The exudate served as potent antigen in inducing immunity to infection in other test animals to which it was administered by intraperitoneal injection.

"*B. anthracis* was cultivated in (1) filtered bovine blood serum, (2) egg solution in physiological saline, (3) milk serum, and (4) in peptone broth to

which was added fresh liver and spleen. The culture media were then again filtered and this material was used (1) in testing their toxic or infection-promoting qualities on guinea pigs and (2) in testing their antigenic qualities on rabbits. *B. anthracis* was also cultivated in filtered equine blood serum, the whole serum and certain dilutions of serum in standard broth being used. These cultures upon incubation were again filtered and used in tests as before. Cultures of young anthrax bacilli in Dunham's peptone solution also were prepared and the bacilli killed as in the preparation of a bacterin. This suspension of bacilli was tested on guinea pigs to determine whether it had any toxic or infection-promoting qualities. Under the conditions of the experiment, no toxic effects or infection-promoting qualities (i. e., aggressin action) were demonstrated in any of the materials used.

"A mixture of anthrax culture filtrates, where 10 and 25 per cent equine blood serum in standard broth served as the culture medium, was found to be a highly potent anthrax antigen. The only animal which was still shown to be susceptible to anthrax after having been treated with this material was one of those receiving the minimal dose. Under the conditions of the experiment whole equine blood serum and 50 per cent of the same in standard broth as well as whole bovine blood serum yielded, on inoculation with *B. anthracis* and subsequent filtration, a somewhat less potent immunizing antigen. This was also true of the milk serum culture filtrate. A filtrate of *B. anthracis* grown in peptone broth to which was added fresh tissue gave no evidence of antigenic value, while egg culture filtrate appeared under the conditions of the experiment to have induced a sensitization.

"The experimental evidence shows that the use of blood serum medium for the cultivation of *B. anthracis* offers a method for the preparation of a potent anthrax antigen, and suggests strongly that the method may prove to be a valuable aid in the protection of farm animals against this dreaded and ravaging disease."

The antigenic value of formolized botulinum toxins, R. Graham, E. A. Tunnicliff, E. C. McCulloch, and F. Thorp, jr. (*Jour. Amer. Vet. Med. Assoc., 75 (1929), No. 1, pp. 21–37*).—A summary of the results of preliminary experiments at the Illinois Experiment Station is said to indicate that formalin and heat may detoxify botulinum toxins without altering a measurable amount of antigenic substance. The amounts of detoxified toxins necessary to protect guinea pigs, chickens, and horses against lethal amounts of the toxin consistently failed to produce the disease and, with certain exceptions, protected animals against lethal amounts of homologous toxin.

Filterable virus and Rickettsia diseases in the Tropics, IV, V, E. B. McKinley (*Porto Rico Rev. Pub. Health and Trop. Med., 4 (1929), Nos. 10, pp. 444–504; 11, pp. 538–580*).—These parts are in continuation of the account previously noted (E. S. R., 61, p. 568).

A benign inapparent form of rinderpest infection: The possible epidemiologic consequences [trans. title], H. Jacotot (*Bul. Soc. Path. Exot., 22 (1929), No. 4, pp. 239–241*).—It is pointed out that in certain subjects considered as refractory to its attack or artificially immunized against the disease, rinderpest may occur in an absolutely inapparent form.

Note on rinderpest in Egypt [trans. title], I. F. Salem (*Egypt Min. Agr., Serv. Tech. et Sci. Bul. 88 (1929), pp. 56*).—A somewhat extended account of the occurrence of and work with this disease in Egypt.

Quail as a possible source of tularaemia infection in man, R. R. Parker (*Pub. Health Rpts. [U. S.], 44 (1929), No. 17, pp. 999, 1000*).—The author reports upon a recent test which resulted in the death of five quail that

ingested feed contaminated with tularemia-infected tissue. This finding is considered to have become of practical significance because of the recent recovery of *Bacterium tularense* by R. G. Green from a quail found dead in nature. The finding of this organism in quail is said to be the first definite evidence thus far secured that any species of game bird may be naturally infected, and the most important observation thus far made in connection with the problem. The histories of two human cases which occurred in the South and the fact that quail are frequent hosts of the rabbit tick (*Haemaphysalis leporis-palustris* Pack.) had suggested the possibility that quail might be a source of human infection.

Brucella abortus in milk and its relation to undulant fever, C. M. CARPENTER and M. J. KING (*New York: Amer. Pub. Health Assoc., [1929], pp. 11, fig. 1*).—This discussion is presented in connection with a list of 20 references to the literature. It is reported that an examination made of the serum from 530 individuals known to have drunk raw milk containing living *B. abortus* from a single herd in which 54.6 per cent of the animals were infected showed 13 per cent of the individuals to contain agglutinins specific for the organism. "Eight from this group were showing definite symptoms of undulant fever at the time the examinations were made, while others gave a history of symptoms suggestive of the disease. The serums from a group of 690 individuals known to have drunk raw milk free from abortus infection or milk carefully pasteurized have shown no agglutinins, nor have any cases of undulant fever occurred in the group.

"A survey of the raw milk supplied to 67 towns, 2 small cities, and 1 city of 200,000 showed the presence of *B. abortus* in 20.4 per cent of the samples examined. A review of 155 case reports of undulant fever due to *B. abortus* showed that 109, or 70.3 per cent, had been drinking raw milk which in the majority of cases was proved to be infected with *B. abortus*. No information concerning the source of the disease could be obtained in 35, or 22.6 per cent, of the cases; 7, or 4.5 per cent, had either been directly in contact with swine or had lived on farms where porcine abortions had occurred; 4, or 2.6 per cent, were considered to be laboratory infections.

"Evidence has been submitted that suggests raw milk, unpasteurized cream, or butter made from unpasteurized sweet cream to be the source of undulant fever in the United States."

Treatment of undulant fever with acriflavine, A. M. HOFFMAN (*Jour. Amer. Med. Assoc., 92 (1929), No. 26, pp. 2169–2171, figs. 3*).—In two cases of undulant fever due to *Brucella abortus* that were treated, the intravenous injection of acriflavine base varying from 0.1 to 0.4 gm. apparently aborted what would have been prolonged sieges of the disease.

Leptospira icterohaemorrhagiae occurrence in wild rats at Toronto, G. C. CAMERON and D. A. IRWIN (*Canad. Pub. Health Jour., 20 (1929), No. 8, pp. 386–392*).—The causative organism of Weil's disease in man was demonstrated in 37 per cent of the 78 wild rats captured in Toronto. Twenty strains, or 69 per cent of the total, were proved to be *L. icterohaemorrhagiae* by their specific pathogenicity for guinea pigs. Guinea pigs were found to vary in their susceptibility to *L. icterohaemorrhagiae*, and more than one animal should be used in attempting to isolate the organism. Only the urogenital tissues of the rat were found to harbor the organism. It is thought that venereal infection may explain the dissemination of Leptospira in these animals. Dark field technic was found to be preferable to histological technic for detecting the organisms. The incidence percentage was found to vary at different periods.

The occurrence of blood groups in domestic animals [trans. title], S. SCHERMER (*Deut. Tierärztl. Wchnschr.*, *36* (*1928*), *No. 48*, *pp. 797–802*, *fig. 1*).—This discussion is presented in connection with a list of 13 references to the literature.

Studies with bovine skin lesions, C. ELDER, A. M. LEE, and T. R. PHILPS (*Jour. Amer. Vet. Med. Assoc.*, *75* (*1929*), *No. 1*, *pp. 51–67*).—The authors report upon work conducted with 35 tubercular lesions, of which 32 were skin lesions, 2 teat lesions, and 1 cervical lymph gland.

"Injections were made into guinea pigs, rabbits, and chickens with all these lesions except 1 of the skin lesions. Six of the skin lesions, 1 of the teat lesions, and the 1 cervical lesion produced tuberculosis in some of the experiment animals. Twenty-one per cent of the skin lesions, including 1 teat lesion, produced tuberculosis in experiment animals. The period of incubation (average, 192 days) was long, illustrating that the organisms in the skin lesion were of low virulence as compared with the usual bovine tubercle bacilli. Acid-fast bacilli were found in 91.1 per cent of the lesions studied. All the experiment animals reported tuberculous died, none being killed. Many experiment animals injected with skin lesions are still living."

Tests with both avian and bovine tuberculin were conducted upon experimental animals, to which none reacted.

Study of udder infections (*Idaho Sta. Bul. 164* (*1929*), *pp. 22, 23*).—In a quantitative bacteriological study, made to establish a norm for each animal in the dairy herd, counts were made of the strippings of 41 animals, most of which were counted on four different occasions. Comparisons of the counts from the fore milk, middle milk, and the strippings were also made for the purpose of deciding which portion of the milkings will give the most representative samples of the udder flora.

In line with the results of previous studies at other stations the fore milk has thus far given uniformly higher counts than any other portion of the milkings. The work on the strippings has shown that there is a norm for each animal provided the animal is still young and healthy. A cow with a history of udder troubles is more apt to give higher counts, even after the lapse of considerable periods of time after the trouble is over. Some of the data gathered have indicated that frequently the strippings yield too few colonies on the plates to give a truly representative sample of the udder flora. The opinion seems to be warranted that a more representative sample can be obtained from the middle milk.

[**Infectious abortion in Idaho cattle**] (*Idaho Sta. Bul. 164* (*1929*), *p. 24*).—The application of the agglutination test for infectious abortion to 955 animals resulted in positive reactions by 23 per cent.

Avirulent vaccine decreases cattle abortion, W. GILTNER (*Michigan Sta. Quart. Bul.*, *12* (*1929*), *No. 1*, *pp. 9, 10*).—This is a report of further study made of this method in cooperation with Michigan dairymen (E. S. R., 61, p. 471). Seven years of study of this avirulent culture has indicated that safe and effective vaccination against infectious abortion is a hopeful possibility that may yet be made practicable.

Milk fever, J. K. MUSE ([*Oklahoma*] *Panhandle Sta.*, *Panhandle Bul. 8* (*1929*), *pp. 7, 8*).—A brief practical account.

Some weedy grasses injurious to livestock, especially sheep, L. H. PAMMEL (*Iowa Sta. Circ. 116* (*1929*), *pp. 12*, *figs. 7*).—The weedy grasses which have caused considerable trouble to sheep and cattle, particularly in southeastern Iowa where the sheep industry is of considerable economic importance, include poverty grass, bristly foxtail, squirrel tail grass, little barley, and awned

bromegrass, all of which are common in the State. Not only do these grasses produce mechanical injuries impairing the eyesight, but the awns and bristles penetrate the skins, gums, and throats of animals. The pelts of sheep are rendered wortbless in some cases by these mechanical injuries or bring below 50 per cent of the normal price.

Toxic effect on sheep of chemicals used in weed control (*Idaho Sta. Bul. 164 (1929), p. 22*).—It was found that a total of 3 oz. of sodium chlorate or calcium chlorate given in two equal doses four hours apart is sufficient to kill yearling wethers weighing approximately 100 lbs. each. When fed on cut alfalfa hay at the rate of 1 to 1.5 or 2 oz. per pound of hay, it greatly reduced the palatability of the feed. At the 2 oz. per pound of feed level it produced symptoms of chlorate poisoning that were evident in poor health and lack of fleshing for more than a month following the poisoning. Whether sufficient chlorate to produce ill effects could or would be taken in on pastures recently treated has not been determined.

The important parasitic worms of sheep in Kenya, R. DAUBNEY (*Kenya Colony Dept. Agr. Bul. 26 (1928), pp. 56, pls. 4*).—A practical discussion of some of the more important helminth parasites of sheep in Kenya.

The control of stomach worms of sheep in central Queensland, I. C. Ross (*Jour. Council Sci. and Indus. Research* [*Aust.*], *2 (1929), No. 2, pp. 75–82*).—A summary of information on stomach worms of sheep and their control by the use of carbon tetrachloride and copper sulfate, supplemented by other measures.

Immunization and serotherapy against swine erysipelas [trans. title], J. BASSET (*Rev. Vét.* [*Toulouse*], *81 (1929), Apr., pp. 181–192, pl. 1; May, pp. 241–255, pls. 2; June, pp. 297–302*).—This is an experimental study of swine erysipelas in the pigeon and in swine.

Chicken disease studies (*Idaho Sta. Bul. 164 (1929), pp. 24, 25*).—Immunization experimental work with fowl pox conducted on four commercial flocks in which it had been endemic for several years resulted in the production of an active immunity in the pullets and nonappearance of the disease. Work with *Salmonella pullorum* infection in fowls has shown the superiority of the antigens containing, respectively, 0.04 per cent sodium hydroxide and 1.8 per cent sodium chloride over nonphenolized and formolized antigens. An investigation of an epiornithic due to *Pasteurella avicida* among turkeys on range showed that irrigation ditches are important channels for the rapid dissemination of this infection.

In agglutination tests for bacillary white diarrhea conducted during the year with 197 flocks comprising 50,000 birds, 33 flocks were found free from reactors. Four per cent of all the birds were reactors.

Bacilliary white diarrhea of fowl [trans. title], LERCHE (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 35 (1929), No. 2, pp. 139–189*).—This extended account of pullorum disease is presented in connection with a list of 88 references to the literature.

B. W. D. control in incubators found at Kansas College, L. F. PAYNE (*Hatchery Tribune, 3 (1929), No. 1, pp. 16, 22*).—The author calls attention to the fact that in experiments at the Kansas Experiment Station formaldehyde gas has proved to be very effective in destroying *Salmonella pullorum* in incubators. Much so-called brooder pneumonia has been found to be due to the development of *S. pullorum* in the lung tissue, and when it is present chicks may die without any symptoms of diarrhea. It may, however, be as fatal when present in the lungs or other vital organs as when it occurs in the digestive tract.

The station has found the correct dose to be 0.35 cc. of formalin mixed with 0.175 gm. of potassium permanganate per cubic foot of incubator capacity. A

2,500 egg incubator with an area of 100 cu. ft. would require 35 cc. of fomalin liberated with 17.5 gm. of permanganate. The disinfection in this way is most effective when the humidity in the incubator is high, registering from 55 to 60° humidity or a wet bulb reading of 90° F. This method of disinfection does not affect the hatchability of eggs, but it does injure the chicks if kept up continually during the hatch. It has been found that a wet bulb reading of 90 to 94° from the nineteenth to the twenty-first days of incubation, when the incubator temperature is 90 to 100°, has a decided effect upon the circulation of chick down and bacteria which float through the air. Low humidity accelerates their movement, while high humidity retards their circulation.

Find abortion germ infects fowls, M. W. Emmel (*Michigan Sta. Quart. Bul., 12 (1929), No. 1, pp. 14, 15*).—Recent experiments made at the station are said to have proved that *Brucella abortus*, the causative organism of bovine abortion, can cause a serious infection in fowl, since in experiments extending over a period of two years, in which a total of 48 birds were exposed artificially to the organism, infection was induced in all but a few. The experimental birds were exposed to the infection in various ways. Milk from the infected udder of the cow, portions of an aborted fetus, and pure cultures of the three members of the genus, isolated from man as well as animal, all produced infection. Two birds were fed one-half pint of infected milk for five days. Although the birds became infected, recovery took place, but it is very likely that continued feeding would have produced a more severe infection. There seemed to be no difference in the ability of the three organisms (*B. abortus*, *B. melitensis*, and *B. suis*) to produce infection in the experimental birds. Death was produced in many cases, a few recovered from the infection, while others were killed at intervals in order to study the various stages of the disease.

The agglutination test applied to the fowl has a high degree of accuracy, but is not an unfailing criterion of infection because during the last stages of the infection the birds do not react. The course of the disease is rather variable. Death may ensue from 18 to 96 days. The birds first show a diarrhea, a paleness about the head, comb, and wattles, and gradually lose weight. The birds become very weak and often show paralysis before death. The presence of these symptoms appears to be very constant. Diagnosis is somewhat complicated by the fact that the lesions found in the organs are rather variable.

One of the most important features in connection with the work with this disease was the finding of natural infection in four flocks. The owners of three of these flocks desired their flocks tested for bacillary white diarrhea because they had fallen off in egg production. A very small percentage reacted to the test for bacillary white diarrhea, while an average of 20 per cent reacted to the test for the abortion germ. Three birds suffering from the infection were received for diagnosis from a fourth flock. This flock contained a large number of birds. Thirty had died and 10 were sick, all showing the symptoms described above. Egg production had dropped from 80 to 65 per cent. Sixteen birds from these flocks were studied in the laboratory and found to have the infection.

Although death may not be produced in all cases, this infection is of great economic importance, due to the decreased egg yield from infected flocks.

Rapid immunization against fowl cholera [trans. title], A. Staub (*Compt. Rend. Soc. Biol. [Paris], 101 (1929), No. 16, p. 106*).—The author reports upon five fowls that were inoculated January 17 with 1/8 cc. of a culture of avian Pasteurella attenuated by the Pasteur method, followed January 19 by 1/8 cc. of a less attenuated culture. Two days later, on January 21, the fowls were resistant and did not react to the intramuscular injection of [illegible] cc. of a

virulent culture sufficient to kill controls in 20 hours. The fowls were found to be solidly immunized.

Further investigations of vaccination against fowl pox and avian diphtheria [trans. title], W. ZWICK, O. SEIFRIED, and J. SCHAAF (*Berlin. Tierärztl. Wchnschr., 45 (1929), No. 12, pp. 183–196, figs. 4*).—The authors find (E. S. R., 60, p. 671) follicular vaccination of the domestic fowl with a fowl-pox virus that has been attenuated by repeated passage through the pigeon to result in a strong immunity. Such passage, however, increases its pathogenicity for the pigeon.

Pigeon-pox virus passed through the fowl is of no value as a vaccine for either bird.

Autopsy findings in field cases of fowl paralysis, K. W. NIEMANN (*Jour. Amer. Vet. Med. Assoc., 75 (1929), No. 1, pp. 38–50, fig. 1*).—This is a report of studies of fowl paralysis conducted at the Kansas Experiment Station.

It is concluded that the incidence of fowl paralysis in flocks previously suffering losses from coccidiosis may go as high as 50 per cent. "The association of tapeworms and other intestinal parasites with fowl paralysis is quite marked. It seems possible that no definite single etiological factor is responsible. Measures designed to control coccidiosis and intestinal parasites will greatly reduce the incidence of the disease. The suggestion that the condition might be caused by more or less specific toxins associated with intestinal disturbances seems plausible."

Manson's eyeworm of poultry, D. A. SANDERS (*Florida Sta. Bul. 206 (1929), pp. 565–585, figs. 3*).—This is a summary of the author's investigations of the parasite, earlier accounts of which have been noted (E. S. R., 60, p. 579).

Experimental treatment of some parasitic intestinal diseases of the fowl and the pigeon [trans. title], J. LAHAYE (*Ann. Méd. Vét., 74 (1929), No. 6, pp. 250–262*).—As a preventive for coccidial reinfection, the author recommends the administration of a mixture of equal parts of powder of catechu, powder of willow, and powder of thyme fed on the grain to the pigeon and in the mash to other fowl. Copper sulfate should be added to the drinking water at the rate of 1.5 gm. per liter. Calomel is a vermifuge that can be used to advantage in combating trichosomes. Tetrachlorethylene is thought to be the only medicament that causes the expulsion of heterakids in a short period of time.

AGRICULTURAL ENGINEERING

Agricultural engineering [investigations at the Idaho Station] (*Idaho Sta. Bul. 164 (1929), pp. 14–16, 41*).—Progress data on experiments on reclamation after drainage, application of irrigation water, combine operation, hay harvesting, the use of electricity in agriculture, and on tillage machinery are briefly presented.

In the work on the rate of infiltration into soil and on the flow of water in thin sheets, a mathematical expression for the flow of water in thin sheets has been developed. The expression is

$$V=KR^{0.5}S^{0.7}$$

where V is the velocity, R the hydraulic radius, S the slope, and K a constant depending upon the soil, etc. For the conditions of the laboratory experiments, K was found to be 1,100.

In the combine studies, data obtained on bulk-handling methods indicate a saving of 1.18 cts. per bushel and show that the bulk handling of grain in the Palouse region is practical provided suitable equipment is selected and proper methods used in the work. It was also found that with slight alterations the

combine may be used successfully for the field harvesting and threshing of peas.

The study of hay harvesting methods showed that the use of slings for handling hay in place of the commonly used Jackson fork saves one-half of the time required for unloading. When a large amount of hay is stacked the motor-driven mechanical hoist has the advantage over animal power by its faster return and more accurate control. For short hauls the use of one sling per load gave the best distribution of labor for field and stacking crews.

[Agricultural engineering investigations at the Nebraska Station] (*Nebraska Sta. Rpt. [1928], pp. 8–10*).—The studies of poultry-house ventilation and construction suggested that there is apparently no correlation between humidity and winter production of eggs in Nebraska. Egg production can be increased by artificial heat, but whether or not the increase is sufficient to warrant the expense is still a question and is somewhat dependent upon the type of heating installation used and the temperatures maintained. Air change in a unit with 4 sq. ft. of floor space per bird has apparently no relation to egg production. Large egg production seems to go with small temperature fluctuation.

In the pump irrigation investigations a wide variation in the cost of pumping and distributing the water was noted among plants operated by stationary gasoline engines, tractors, and electric motors, ranging from an estimated cost per crop acre per season as low as $1 to as high as $13, exclusive of investment expense. The higher cost has generally been found where an attendant was kept constantly at the plant. The expense of pumping was found to be from 2.9 to 30.16 cts. per acre-foot per foot of lift, not including investment expense.

The investigations of the use of electric power on Nebraska farms showed with deep well automatic water systems a current consumption varying from 0.083 to 2.012 kw. hours per 1,000 gal. per foot of lift. With shallow-well automatic water systems the current consumed was 0.024 kw. hour per 1,000 gal. per foot of total maximum head. A survey of the use of small unit light plants on farms showed among other things that the life of the battery is not shortened if the current is used for a number of different things rather than for light only.

Irrigation districts in California, F. Adams (*Calif. Dept. Pub. Works, Div. Engin. and Irrig. Bul. 21 (1929), pp. 421, pls. 31, figs. 10*).—The results are reported of an investigation of irrigation districts and the irrigation district movement in California, conducted cooperatively by the California Experiment Station, the U. S. D. A. Bureau of Public Roads, and the California Department of Public Works (E. S. R., 35, p. 284). Chapters are included on forms of districts for irrigation or water conservation authorized by California statutes, the irrigation-district movement in California since 1897, the development of the California irrigation district law since 1897, active California irrigation districts, inactive or partially active irrigation districts, and the status of districts organized for irrigation or water conservation other than irrigation districts.

The conclusion is drawn that the essential principles of the California irrigation district law are sound and workable, and that State administrative control of irrigation district organization and financing, as evolved in California during the last two decades, is stabilizing irrigation development in the State.

"No irrigation district can afford to lay out its irrigation system or construct its works without the advice of a professional engineer in each important phase of the work to be undertaken. This is true not only of the main construction, but also of the less important engineering features, and the agricultural economic problems involved.

"Irrigation districts primarily promoted by others than the owners of the lands to be directly benefited require special scrutiny at the hands of reviewing authorities. It is not important who initiates an irrigation-district project, *but it is important that the landowners within the proposed enterprise shall* from the beginning exercise guiding control in its organization and development; also that the problems of those who are to farm the land to be benefited shall be given their due consideration in connection with the indebtedness and operating charges that are incurred."

Simple laboratory experiments on capillary movement and entrapped air in clays, D. P. Krynine (*U. S. Dept. Agr., Public Roads, 10 (1929), No. 6, pp. 114, 115, figs. 4*).—Results of studies conducted at the Moscow Superior Technical School and Institute of Transportation Engineering are reported briefly. These indicate that in dry clay capillary movement may take place upward, downward, or laterally, and that the usual terms "capillary rise" or "capillary upward movement" convey an inexact idea and should be used to express a restricted meaning only. It is pointed out that capillary movement is due to molecular attraction of water by clay particles. During capillary movement water replaces air in soil pores and drives it forward.

Corrosion of metals as influenced by surface films, F. N. Speller (*Mech. Engin. [New York], 51 (1929), No. 6, Sect. 1, pp. 431–434*).—A brief review is presented of the more important facts relating to the influence of metal surface films on corrosion, special attention being given to films and surface protective layers formed mainly by external reagents.

The influence of well-known alloying metals on the film-forming capacity of iron is also discussed. The conclusion is reached that rust-resisting alloys, such as high-chrome iron and "stainless steel," probably owe their resistant properties to the stable films formed under certain conditions, and therefore that the life of these metals is more directly dependent on the stability of the film formed than on the initial tendency of the metal to corrode. Some metals evidently have much more of this self-protecting property than others.

The gluing of wood, T. R. Truax (*U. S. Dept. Agr. Bul. 1500 (1929), pp. 78, pls. 13, figs. 18*).—The purpose of this publication is to bring together essential information about glues and gluing, to set forth important principles of control in the gluing operation, and to outline methods found satisfactory. It has as a background a large amount of experimental work. Glue formulas are given in an appendix, together with engineering data on the calculation of pressure on glued joints. A list of 54 references to literature bearing on the subject is included.

Public Roads, [August, 1929] (*U. S. Dept. Agr., Public Roads, 10 (1929), No. 6, pp. 101–116+[2], figs. 17*).—This number of this periodical contains the status of Federal-aid road construction as of July 31, 1929, together with the following articles: Roadside Plan and Progress in Massachusetts, by J. H. Taylor (pp. 101–109; Effect of Method of Fabrication on Strength and Uniformity of Flexure Specimens, by L. W. Teller (pp. 110–112, 115); Effect of Moisture Content on the Strength of Cement Mortar Specimens, by D. O. Woolf and B. Smith (p. 113); Simple Laboratory Experiments on Capillary Movement and Entrapped Air in Clays, by D. P. Krynine (pp. 114, 115) (see above); and Relation of Coarse Aggregate Content to the Quality of Pavement Concrete to Be Studied (p. 116).

Electric power for the farm, E. W. Lehmann and F. C. Kingsley (*Illinois Sta. Bul. 332 (1929), pp. 373–479, figs. 30*).—The results of a study of the use of electric power on Illinois farms are presented in considerable detail, and it is pointed out that the distribution of electric power in the State has reached a point where many areas remote from the centers of population have electric

service available. This study differed from similar projects in which individual items of equipment were studied in that a number of pieces of equipment were installed on each farm, and the use, value, and energy requirement were determined in relation to other types of equipment.

It was found that the cost of wiring and fixtures and the cost of electrically operated equipment incident to the use of electric service are the two factors which limit its use on the farm.

The farms on the experimental line use more electricity in the home than in production work, the kitchen range and the household refrigerator consuming the most electricity. The results of tests demonstrated that electricity is an economical and practical form of energy for operating milking machines, cream separators, seed germinators, feed grinders, silage cutters, incubators, brooders, pumps, portable motors, wood saws, feed mills, and other power-driven equipment.

The 10 cooperating farmers on the experimental line were found to be using about five times as much electric energy as the average city lighting customer. The results in general indicate that many farmers can make sufficient economical use of electric energy to justify power companies in building farm lines.

The unit electric plant was found to furnish sufficient energy for lighting and for operating small motors and small appliances. However, the cost of energy from the unit plant is greater than from the central station plant when served under existing rates in effect on the experimental line.

The use of electricity on Missouri farms, R. R. PARKS (*Missouri Sta. Bul. 268 (1929), pp. 47, figs. 27*).—A large amount of data obtained on the use of electricity on certain test farms in Missouri is summarized in this publication. The results indicate that the cost of electricity for the farm is dependent first on the cost of operating and maintaining electric lines to the farm and second on the cost of generating electricity and delivering it to the farm over farm lines. It is evident that the first cost remains about the same regardless of the quantity of electricity used. Therefore, no matter what is the basis of charge, the cost per kilowatt-hour of electricity delivered to the farm decreases with the quantity used. According to a typical rural rate used in Missouri, the charge for the first 35 kw. hours used per month was $4.55, for the next 35 kw. hours $1.75, and for the next 130 kw. hours $3.39, making a total of 200 kw. hours and $9.69.

Rural electric service supplied from central stations in Nebraska in 1927, E. E. BRACKETT and E. B. LEWIS (*Nebraska Sta. Bul. 236 (1929), pp. 17, figs. 12*).—Data are presented and discussed on average annual revenue per consumer in municipalities and private utilities, average revenue per mile on rural service lines, average kilowatt-hours per year per consumer, average revenue per kilowatt-hour, average number of consumers per mile on pole lines serving farms only, average kilowatt-hour consumption per month over two- and three-year periods, farm line transmission losses, and farm electric equipment.

Unit electric plants for Nebraska farms, E. E. BRACKETT and E. B. LEWIS (*Nebraska Sta. Bul. 235 (1929), pp. 28, figs. 9*).—The results of a survey of present conditions and a study of 30 different makes of battery-type plants, 2 makes of automatic type, and 1 semiautomatic type in use for ordinary purposes on Nebraska farms are presented. The plants range in size from 600 to 3,000 watts. The 850-watt size was the most common battery-type plant and the 1,500-watt size the most common automatic type found. Farmers having battery-type plants reported a total of 29 different uses for electricity, while those having the automatic type reported a total of 36 different

uses. It was found that increasing the number of uses of electricity from a plant apparently did not shorten its life.

The oldest battery-type plant from which data were secured was 20 years old, and the average age of all battery plants investigated was 6.16 years. The oldest automatic plant studied was 7 years old. The range in the age of battery-type plants reported worn out or discarded because badly worn was from 7 to 11 years. Plants on which careful measurements of fuel and oil consumption were made showed costs of from 11.7 to 15.25 cts. per kilowatt-hour for fuel and oil when averaged over a period of 1 year under ordinary service to the owner. The average life of batteries reported worn out in service was 6.03 years. The 80-ampere-hour battery had shorter life than the 160-ampere-hour battery when discharging for the same number of uses of electricity, but the estimated cost of charging was much the same and the initial cost of the 80-ampere-hour battery was much less. Batteries worn out in service as starting batteries on automatic plants had an average life of 2.4 years.

Progress report on the use of small electric motors for (1) cutting ensilage, (2) sawing wood, (3) grinding feed, H. B. JOSEPHSON and R. U. BLASINGAME (*Pennsylvania Sta. [Pamphlet], 1929, pp. 15*).—Progress results of three sets of experiments are presented. Five tests were made on the use of small electric motors for silage cutting, and the data are presented and discussed. The results indicated the importance of sharp knives and that the cutter should operate from 350 to 450 r. p. m. The knives should be adjusted close to the shear plate, and the fan blades should be 0.25 in. or closer to the fan housing. A 6-in. belt appears to be satisfactory, having pulley shafts about 15 ft. apart. It appears probable that 7.5-h. p. motors will be preferable to 5-h. p. motors where silo filling, threshing, feed grinding, and the like are to be done, on account of the reserve power for peak loads.

In the wood-sawing tests it was found that the 7.5-h. p. motor consumed 1.01 kw. hours of electrical energy and gave slightly better economy than the 5-h. p. motor, which used 1.14 kw. hours per cord of wood sawed.

The feed grinding was done with 3-, 5-, and 7.5-h. p. motors driving 6-, 7-, 8-, and 10-in. plate or burr mills. With the 3-h. p. motor oats were ground with an 8-in. mill at the rate of 425 lbs. per hour to a fineness of 3.48. The energy consumption was 1 kw. hour per 100 lbs. The rate of cracking shelled corn was 2,922 lbs. per hour. Barley was ground at the rate of 822 lbs. per hour with an energy consumption of 0.49 kw. hour per 100 lbs. and a fineness of 3.46. A 5-h. p. motor ground oats in a 6-in. plate mill at the rate of 491 lbs. per hour and an energy consumption of 0.98 kw. hour per 100 lbs. and a fineness of 3.63. Corn was ground at the rate of 940 lbs. per hour. With the 7-in. mill the rate of grinding oats was 542 lbs. per hour, the energy used was 0.88 kw. hour per 100 lbs., and the fineness of grinding 3. With an 8-in. mill oats were ground at 771 lbs. per hour and the energy used was 0.7 kw. hour per 100 lbs. With the 7.5-h. p. motor driving an 8-in. plate mill the rate of grinding was 739 lbs. per hour with an energy consumption of 0.82 kw. hour per 100 lbs. and a fineness of 3.51. With a 10-in. plate mill oats were ground at the rate of 815 lbs. per hour with an energy consumption of 0.87 kw. hour per 100 lbs. and a fineness of 3.52.

Similar data are given for other grains and conditions and for cutting fodder. No conclusions were drawn.

Wiring the farmstead, B. BAINER and H. S. HINRICHS (*Kans. Agr. Col. Ext. Bul. 63 (1929), pp. 20, figs. 17*).—Practical information is presented, primarily for the use of electrical contractors, on the wiring of farmsteads for electric service, including both lighting and power.

Wiring the farm for light, heat, and power, B. P. Hess, H. S. Hinrichs, E. A. Stewart, T. A. Wood, L. C. Prickett, et al. (*C. R. E. A. Bul.* [*Chicago*], *5* (*1929*), *No. 1, pp. 77, figs. 88*).—This is a complete treatise on farm wiring.

Farm lighting, F. C. Fenton and O. D. Hunt (*Kans. Agr. Col. Ext. Bul. 64* (*1929*), *pp. 17, figs. 15*).—Practical information on the subject is given, special attention being devoted to the use of electricity for the lighting of dwellings and animal shelters.

Silo filling with five horse power electric motor, H. J. Gallagher (*Mich. Agr. Col. Ext. Bul. 87* (*1929*), *pp. 4, fig. 1*).—The set-up for the operation of a silo filler with a 5-h. p. motor is described, and the results of actual experience on the operation of the outfit are briefly presented. Results indicate that silos can be filled with a 5-h. p. motor which are as much as 75 ft. in height if the proper set-up is made.

A report on the development and costs of the Oxford process for the production of sugar from sugar beet, B. J. Owen (*Univ. Oxford, Inst. Research Agr. Engin. Bul. 4* (*1929*), *pp. 55, pls. 11*).—Data on the operation and costs of this process are presented and discussed, together with a large amount of tabular and other data and drawings of the equipment.

Seven years' experience with the combined reaper-thresher, 1922–1928, J. G. Taggart, J. K. Mackenzie, and E. S. Hopkins (*Canada Dept. Agr. Bul. 118, n. ser.* (*1929*), *pp. 27, figs. 11*).—The detailed results of seven years' experience with the combine at the Swift Current, Sask., Experimental Station are presented and discussed. These indicate that on the average wheat farm the introduction of a combine does not necessarily entail any drastic change in farm practices. In general the methods that have proved profitable in grain farming when the crops were harvested by the binder and separator will be found quite suitable when farming for the combine. A crop which is free from weeds and matures uniformly is highly desirable when the combine is used.

One outstanding result of the introduction of a combine on a farm is that the peak load of work is transferred from the fall to the spring. The combine largely eliminates the necessity for a large crew in the harvest season. Owing to the increased necessity for early maturity, it enhances the desirability of early seeding, and thus it has been a motive behind the increased demand for one-way disks, larger disk harrows, and wide seed drills. The combine has also been a factor in increasing the number of medium-powered tractors.

Binder and knotter troubles, J. M. Smith (*Alberta Univ., Col. Agr. Bul. 10, 3. ed., rev.* (*1929*), *pp. 96, figs. 88*).—This is the third revised edition of this bulletin (E. S. R., 56, p. 384).

Life, service, and cost of service of farm machinery, J. B. Davidson (*Iowa Sta. Bul. 260* (*1929*), *pp. 257–275, figs. 4*).—The results of a study are reported which indicate that the average life of farm machines on Iowa farms varies from 8 years for spring-tooth harrows to 24 years for the farm wagon. An average life for all machines is 15.2 years. The life of individual machines was found to vary much from the average. The average life of grain binders, for example, was found to be 16 years, but machines were encountered which lasted only 5 years, while others had a life of 33 years.

The average annual service of farm machines in days of actual use is very low, varying from 4 days for the seeder to 80 days for the wagon and gasoline engine. The average annual use of all farm machines is 16 days. With few exceptions, the life of farm machines is not directly influenced by the number of days used per year.

The annual cost of repairs was found to vary from 0.5 per cent of the first cost for the roller, seeder, and spring-tooth harrow to 5 per cent for one-row cultivators. The average cost of service for one day varies from 8 cts. for the one-row cultivator to $10.11 for a silage cutter. It appears that the total annual cost of a farm machine varies from 12 to 21 per cent of the first cost. While the housing of farm machinery is desirable, systematic repairing has more influence on its life. Apparently the most important factor in reducing the cost of each day's service is a large number of days of use per year.

Agricultural implements and machinery at Pusa, I–IV, G. S. Henderson and A. Singh (*Agr. Research Inst., Pusa, Buls. 191 (1929), pp. [3]+9, pls. 7, figs. 2; 192, pp. [3]+3, pls. 4; 193, pp. [3]+3, pls. 7; 194, pp. [3]+7, pls. 9*).—Implements and machinery used in Indian agriculture are briefly described and illustrated.

The termite-proof construction of buildings in Ceylon, F. P. Jepson (*Ceylon Dept. Agr. Bul. 85 (1929), pp. IV+36, pls. 26*).—A description is given of termite injury to wooden structures in Ceylon and some practical information presented on protection.

Making cellars dry, G. M. Warren (*U. S. Dept. Agr., Farmers' Bul. 1572 (1929), pp. II+29, figs. 19*).—This supersedes an article entitled Securing a Dry Cellar, previously noted (E. S. R., 43, p. 485), and gives practical information on the causes of dampness and wetness in cellars, on methods for the exclusion of rain and drainage water, and on damp-proofing of cellar walls. Information is also given on the improvement of old cellars.

Water carried for household purposes on Nebraska farms, M. R. Clark and G. Gray (*Nebraska Sta. Bul. 234 (1929), pp. 22, figs. 4*).—Results of a survey of the amount of water carried for household purposes on Nebraska farms are summarized. No relationship was found between the person carrying water and the number of persons in the household. Cream separators were found to create a demand for water peculiar to the farm home. An average of 178.8 gal. of water was used by each household, or an average of 41.1 gal. per person per week and 5.9 gal. per person per day. Water used for general household purposes was carried an average distance of 75.7 ft. and that used in the laundry an average distance of 62.6 ft. Each week an average distance of 4,311.5 ft. was traveled in carrying water in each household. The time consumed by each household in this work was on the average 2 hours and 20 minutes per week for general household purposes and 46 minutes for laundry purposes.

RURAL ECONOMICS AND SOCIOLOGY

[Rural economics investigations at the Ohio Station] (*Ohio Sta. Bimo. Bul. 140 (1929), pp. 173–176*).—Results are reported as follows:

The combined harvester-thresher in Ohio in 1928, J. H. Sitterley (pp. 173, 174).—Personal interviews with 75 combine owners who had harvested 14,371 acres in 1928 with combines, principally 10-ft. size, showed that the rate of harvesting varied from less than 0.5 to over 3.5 acres per hour, averaging 1.7 acres; that approximately 1 man hour was required per acre as compared with 5 hours with a tractor-drawn binder and stationary thresher; that 50 per cent more machine hours were required with the binder and thresher; and that the total cost was a little less than twice as great with the binder-thresher method.

Relation of net cash receipts and expenditure for family living, C. E. Lively (pp. 174, 175.)—A table is given showing the size of household, total net cash receipts, cash expenditures (total and for food), and the value of food furnished by the farm for 66 Ohio farm families in 1927, grouped according to net cash

receipts. A direct correlation was found between total expenditure for living and net cash receipts, but no significant correlation was found between net cash receipts and expenditure for food and little relation between net cash receipts and value of food furnished by the farm.

Index numbers of production, prices, and income, J. I. Falconer (p. 176).—The table previously noted (E. S. R., 61, p. 684) is brought down through June, 1929.

Contemporary agricultural law, A. J. SPENCER (*Jour. Roy. Agr. Soc. England, 89 (1928), pp. 141-155*).—Brief summaries are included of the more important acts of Parliament and decisions of the courts during 1928 affecting agriculture.

A guide to agricultural policy, J. P. MAXTON (*Ruskin Col. [Oxford] Study Courses, No. 3 (1929), pp. 47*).—The methods of the recognized political parties of Great Britain for applying the resources of the State to the solution of agricultural and rural problems are described and briefly discussed.

Land valuation, II (*Missouri Sta. Bul. 269 (1929), pp. 47*).—This bulletin, the second in the series previously noted (E. S. R., 58, p. 489), presents in a condensed form the following papers delivered at the second short course in land valuation, held July 24 and 25, 1928: Evaluating Land for Taxation Purposes, by J. T. Waddill (pp. 4-7); The Difficulties in Our Present System of Land Taxation, by D. C. Wood (pp. 8-14); Management of Foreclosed Farms, by C. A. Helm (pp. 14-17); Farm Indebtedness, by D. C. Wood (pp. 18-28); Soil Fertility as a Factor in Land Appraisal, by M. F. Miller (pp. 29-32); The Current Farm Real Estate Situation (p. 32) (E. S. R., 61, p. 79), and The Effect of Farm and Community Improvements on Land Values (pp. 32-39), both by E. H. Wiecking; The Problem of Marginal Lands, by O. R. Johnson (pp. 39-42); and The Use of Soil Maps for Land Appraising, by H. H. Krusekopf (pp. 42-47).

Mexican labor in the United States: Imperial Valley, P. S. TAYLOR (*Calif. Univ. Pubs. Econ., 6 (1928), No. 1, pp. 94*).—This is the first of a series of studies on Mexican labor in the United States, initiated by, and being carried on as a project of, the Committee on Scientific Aspects of Human Migration of the Social Science Research Council. Nearly one-third of the population of the Imperial Valley are Mexicans, and the greater percentage are agricultural laborers.

The publication discusses the labor history of the valley, the labor market, labor relations, housing, the socio-economic ladder, property ownership, education, and the domiciliary and social isolation of the Mexican population.

State systems of taxation for public schools, IV, V, F. H. SWIFT (*Amer. School Bd. Jour., 78 (1929), No. 6, pp. 55, 56, 141; 79 (1929), No. 1, pp. 49, 50*).—These are the fourth and fifth articles in the series previously noted (E. S. R., 61, p. 287).

IV. *The Montana plan.*—For 1925-26, 7.84 per cent of the school revenues were derived from the permanent public-school fund, 2.16 from metal mines, oil license, and inheritance taxes, 0.26 from State general fund appropriations, 50.79 from school district general property taxes, 35.36 from county general property taxes, 2.44 from fines, proceeds of sales of school property, etc., and 1.15 per cent from Federal grants and subventions.

The legislature of 1927 created a State common-school equalization fund, to which are to be credited 50 per cent of the proceeds of the State inheritance tax and the oil license and metal mines taxes formerly credited to the common-school interest and income fund.

V. *The Massachusetts plan.*—Massachusetts was a pioneer in using the income tax as a definite source for school revenues. Of the State aid to schools

in 1926, 2.8 per cent was from the permanent school fund, 33.9 from appropriations from ordinary revenue or general fund, and 63.3 per cent from the State income tax, receipts being 22.8 per cent of the total returns from that tax.

Recent changes in systems of husbandry in England, H. E. Armstrong et al. (*[Rothamsted Expt. Sta., Harpenden], Rothamsted Conferences, No. 8 (1929), pp. 56*).—This is the report of a conference at Rothamsted, November 27, 1928, and consists of papers as follows: Recent Changes in Systems of Husbandry in England, by J. Russell (pp. 7–11); The Relative Advantages of Intensification or Extensification of Farming, by C. S. Orwin (pp. 11–16); Changes in the Home of the Four-Course Rotation, by F. Rayns (pp. 17–25); The Entry of Sugar-Beet into the Economy of the Farm, by G. H. Long (pp. 25–28); Recent Changes in Systems of Farming in Buckinghamshire, by J. Porter (pp. 28–32); Changes in Cropping Systems in Hertfordshire, by J. W. Reid (pp. 33–38); Recent Changes in Northamptonshire Husbandry, by W. A. Stewart (pp. 38–42); Agricultural Conditions in Nottinghamshire as Affected by Recent Changes, by R. N. Dowling (pp. 42–45); Recent Breaks from the Old Rotation in Sussex, by H. Drewitt (pp. 45–48); Recent Changes in the System of Husbandry in South Lincolnshire, by J. C. Wallace (pp. 48–50); Recent Changes in Cheshire Husbandry, by W. B. Mercer (pp. 51–53); and Fruit and Vegetables as an Adjunct to the Farm, by H. V. Taylor (pp. 53–56).

The crop system in Iowa County, J. A. Hopkins, Jr. (*Iowa Sta. Bul. 261 (1929), pp. 277–316, figs. 14*).—This bulletin, which reports the results of a study made in cooperation with the U. S. D. A. Bureau of Agricultural Economics, is based on detailed records kept on 28 farms, 22 records being obtained in 1925 and 1926 and 18 in 1927, and on data regarding acreages and yields of crops in 1928 obtained by visits to the farms.

Tables are given and discussed showing the use of land on the farms, by size groups; distribution of land and yields, by soils and topography; the physical and financial costs per acre, by years and the low and high costs in 1927, of corn, silage, shredded fodder, oats, barley, wheat, mixed hay, and timothy seed; and the expenses and yields on four alfalfa and three sweetclover fields.

Suggestions are made as to rotation systems.

The utilization of marginal lands, W. Allen (*New York Cornell Sta. Bul. 476 (1929), pp. 109, figs. 7*).—The data on which this bulletin is based were collected in a survey made in July to September, inclusive, 1924, in Pharsalia Township, Chenango County, and Ellery Township, Chautauqua County, New York. An attempt was made to get information relating to every parcel of land of 10 acres or more included in the areas surveyed. The farm records obtained, which cover chiefly the year ended April 30, 1924, are analyzed for each area under the headings of topography and elevation, climate and rainfall, the people, employment history of farm operators, labor on farms, farm capital, size of farms, livestock and dairy products, crops, pasture, woodlots, farm buildings, farm equipment, soils, work outside of the farm, farm expenses, taxes, farm finances, and tenure.

After paying expenses on the 98 operated farms in Pharsalia Township, the average amount left per farm for interest, board of hired help, and family and operator's labor was $588, averaging $733 for 51 farms and $431 for 47 farms. It is proposed that these latter farms be placed in forest projects. The average yields and values of crops, major imported materials, labor costs, investment, and taxes per farm for the 47 and 51 farms are compared.

Somewhat better conditions were noted in Ellery Township, although the farmers of this area had very little remaining after all necessary costs had been met.

The adjustment of agricultural production to meet home market demands in the Clifton Forge-Covington trade area, J. J. Vernon, T. D. Johnson, and W. O'Byrne (*Virginia Sta. Bul. 266 (1929), pp. 30, figs. 3*).—This bulletin, prepared in cooperation with the U. S. D. A. Bureau of Agricultural Economics, consists of two parts, the first (pp. 3–22) by Vernon and Johnson with the title given above, and the second (pp. 23–30), The Place of Timber Growing in the Development of the Clifton Forge-Covington Trade Area, by O'Byrne.

The first part includes statistics as to tenancy, population, postal receipts, purchasing power, weather, land utilization, number of farms, farm organization, production of different crops, fruits, vegetables, different kinds of livestock, milk, and poultry in the counties tributary to Clifton Forge and Covington, and makes suggestions as to methods of increasing net farm returns.

The second part discusses distribution and uses of wooded and forest land in Alleghany County, timber as a crop, handling of the timber crop, and the place of timber growing in the county.

White Mountain demand for vegetables and poultry products, E. H. Rinear (*New Hampshire Sta. Bul. 241 (1929), pp. 26, figs. 4*).—This bulletin, which continues earlier work (E. S. R., 55, p. 688), is based chiefly upon data obtained during August, 1928, from managers and stewards of ten White Mountain hotels and several Boston wholesalers furnishing vegetables, eggs, and poultry to the hotels. Tables and graphs are given showing the weekly demand for the different vegetables, eggs, and poultry and the prices paid for locally produced and shipped-in supplies. The preferences of the hotels and the problems in supplying the needs locally are discussed.

The grape industry (*San Francisco: Calif. Vineyardists Assoc., 1929, pp. 15*).—This is a statement based upon research of the California Vineyardists Association as to the economic position of the industry and its problems, and the plans of the association for improving conditions in the industry.

Marketing California grapes (*New York: Metrop. Life Ins. Co., 1928, pp. 128, figs. 3*).—The results are reported of a survey of grape marketing and distribution made by the distribution and marketing service of the Metropolitan Life Insurance Company at the request of the California Vineyardists Association. The data are analyzed under the headings of consumer demand for grapes, packing grapes for the market, distribution and sales methods, a study of the New York market, and credit aspects of grape marketing. Recommendations are included.

Reducing cotton production costs by the utilization of improved machinery, F. R. Jones (*Agr. Engin., 10 (1929), No. 6, pp. 183–188, figs. 3*).—The progress data of an investigation at the Texas Experiment Station of the use of improved machinery in cotton production are presented and discussed.

The results indicated that bedding is the heaviest operation and cultivating is the lightest in cotton production, especially where 2-row equipment is used. With one tractor handling 100 acres and a yield of one-half bale per acre, the costs of production of the crop per acre and per pound of lint are approximately $25 and 10 cts., respectively. With one tractor handling 100 acres and a yield of one bale per acre, the cost of production of the crop per acre and per pound of lint is approximately $35 and 7.01 cts., respectively.

The data also show the importance and advantage of a high yield over a low or average yield. In other words, the cost of producing a high yielding crop is very little more than the cost of producing a crop of average yield.

Potato production costs in New Hampshire, M. F. Abell (*New Hampshire Sta. Bul. 239 (1929), pp. 35, figs. 2*).—This bulletin is based on data collected by the survey method from nearly 200 farms in 1926 and 1927 and on detailed

labor records of 12 farms. About 10 per cent of the potatoes raised in the State are represented. An analysis is made of the relation to yield and labor per acre and labor and cost per bushel of soil, acreage in potatoes, distance to market, length of rotation, date of planting, amount of seed used, source of seed, amount and method of applying fertilizers and sprays, machine and hand planting and digging, etc. Other tables show the distribution of man labor in the different counties, methods of marketing, the hours and cost of man, horse, and tractor work, and the amount and cost of seed and materials in the different counties.

The study shows that the use of special machinery saved from three to five days' labor per acre, that such machinery was economical on areas as small as 3.8 acres, that acreage was one of the most important factors affecting labor requirements, that yields increased with increase in acreage, that yields did not warrant application of much over 1 ton of fertilizer per acre, that spraying more than paid for the material and labor costs, that the amount of seed per acre was more important than the amount of fertilizer and manure, that certified seed increased yields from 10 to 50 bu. per acre, that labor requirements were much less on the farms using short rotations, that early planting in some counties and mid-season planting in other counties gave the largest yields and lower costs per bushel, and that one-man planters gave as satisfactory results as to yields as two-man planters.

Organization and management of tomato canning factories in Arkansas, C. E. Campbell (*Arkansas Sta. Bul. 240 (1929), pp. 32, figs. 6*).—This bulletin is based upon data obtained from owners and operators of 72 canning factories in northwestern Arkansas, canning costs being obtained from the accounting records of 31 factories; from bankers serving the canners; and from 55 wholesale grocers in Arkansas, Oklahoma, Texas, and Louisiana.

A table is given and discussed showing by items for 1927 and 1928 the average cost of canning and selling tomatoes (No. 2 cans). Graphs show the demands on working capital by months, the fixed and working capital required, and the total value and value added by canning, by factors producing each, in 1927. The marketing of canned tomatoes and the problems of the industry are discussed.

The average costs, 1927 and 1928, per case of No. 2 cans were for raw product 33.59 cts.; labor (hired) 20.54; labor (owners and managers) 18.60; cans, cases, labels, and miscellaneous supplies 69.87; power and water and machinery rental 2.51; taxes and insurance 2.52; interest and depreciation 9.87; swells 0.54; office and general expenses 3.37; and selling 5.43 cts.; total $1.6684. The average selling price during recent years was found to be approximately $1.76 per case. The total value per case added by canning was 49 cts. Of this, 49.3 per cent was due to hired labor, 17.5 to owner's labor, 22.4 to borrowed capital, and 10.8 per cent to owner's capital.

Why hog profits vary, J. A. Hopkins, Jr. (*Iowa Sta. Bul. 255, abridged ed. (1929), pp. 12*).—A popular edition of the bulletin previously noted (E. S. R., 60, p. 484).

Practices and problems of cooperative livestock shipping associations in Illinois, R. C. Ashby (*Illinois Sta. Bul. 331 (1929), pp. 349–372, figs. 9*).—This bulletin is based on data obtained by visits to 328 organizations between July and December, 1926, inclusive; interviews with managers or directors of 252 associations; and information by mail from 182 others. Included were 20 county shipping associations, 32 elevators shipping livestock cooperatively, and 382 local shipping associations. All reports were for 1925 operations. The accomplishments, volume of business, operation and management, and problems of such associations are described and briefly discussed.

Of 422 associations reported on, 30.33, 27.25, and 27.49 per cent, respectively, shipped 25 or less, from 26 to 50, and from 51 to 100 cars during the year. In 309 associations the local expenses per hundredweight shipped were 7 cts. or less in 11 per cent, from 7 to 11 cts. in 59.55 per cent, and 11 cts. or more in 29.45 per cent. The most frequent managers' commissions were from 5 to 8 cts. and 10 cts. per 100 lbs. for both cattle and hogs. The most common sinking fund charges were 2 or 3 cts. per 100 lbs.

The marketing of livestock in Maryland with particular reference to the Baltimore market (*Maryland Sta. Rpt. 1928, pp. VII–IX*).—The conclusions and results regarding the favorable and unfavorable conditions of the Baltimore livestock market obtained in a study made by B. B. Powell are reported.

Developing new markets for Missouri butterfat, F. L. Thomsen and W. H. E. Reid (*Missouri Sta. Bul. 267 (1929), pp. 32, figs. 12*).—The production conditions, the present development of market outlets, and the present system of marketing butterfat in Missouri are described. The advantages and disadvantages of different market outlets for butterfat are discussed. The conditions under which each market outlet is most likely to succeed are pointed out, and the conditions actually existing in Missouri are shown.

Surplus milk and milk residues, A. MacNeilage, Jr. (*Hannah Dairy Research Inst. Bul. 1 (1929), pp. 66, figs. 8*).—This is a report of an investigation into the utilization and marketing of surplus milk and milk residues conducted by the Hannah Dairy Research Institute for the Scottish National Milk and Health Association and the Empire Marketing Board. The survey covered the mainland of Scotland, excluding north of the Caledonian Canal and west of the Firth of Clyde.

The report deals with the location, extent, and methods of utilization of surplus milk and milk residues, and the organizations and methods in other countries.

Foreign markets for United States eggs, M. A. Wulfert (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Trade Inform. Bul. 584 (1928), pp. II+13*).—Statistics are given as to the exports of eggs from the United States and imports into different countries. The several foreign markets are described and discussed.

Poultry and egg outlook charts, with explanations (*U. S. Dept. Agr., Bur. Agr. Econ., 1929, pp. [51], figs. 25*).—This is a series of 25 charts with explanations covering number of chickens on farms, egg production, prices of eggs and farm products, New York City egg receipts, prices and cold storage holdings of eggs and poultry, cost of shipping poultry, imports of eggs, etc.

Crops and Markets, [August, 1929] (*U. S. Dept. Agr., Crops and Markets, 6 (1929), No. 8, pp. 281–328, figs. 3*).—The usual tables, graphs, reports, summaries, etc., are included (E. S. R., 61, p. 787), together with the lamb crop report, 1929; the sheep and wool outlook, August, 1929; and a table showing the unloads of 18 fruits and vegetables in 66 cities during 1928.

Agricultural cooperation in the Soviet Union, G. Ratner (*Die Landwirtschaftlichen Genossenschaften in der Sowjetunion. Berlin: Paul Parey, 1928, pp. 64, fig. 1; London: George Routledge & Sons, 1929, [Eng. ed.], pp. XII+90, fig. 1*).—This publication describes the present position, legal foundations, commercial activities, financial position, foreign trade, and representation abroad of the agricultural cooperatives of the Union of Socialistic Soviet Republics, and the work and character of the various central unions.

The English translation, by M. Digby, is edited by the Horace Plunkett Foundation.

Cooperative buying in West Virginia, P. A. Eke (*West Virginia Sta. Bul. 221 (1929), pp. 55, figs. 8*).—The data on which this bulletin is based were obtained from detailed schedules from 7 car-door and 13 warehouse associations filled out through visits to the places of business, examination of records, and interviews with directors and managers of the associations, county agricultural agents, and farm bureau officers. It discusses and gives information regarding organizing, financing, managing, and operating the two types of associations.

The West Virginia Cooperative Marketing Act of 1923, suggested by-laws for a cooperative supply company, and a suggested balance sheet and operating statement for cooperative associations are included.

Effects of industrial development on rural life in Sullivan County, Tennessee, C. E. Allred and J. C. Fitch (*Tenn. Univ. Rec., Ext. Ser., 5 (1928), No. 3, pp. 45*).—This bulletin is based upon data obtained by the Tennessee Experiment Station and the Bureau of Agricultural Economics, U. S. D. A., in two localities similar in topography and soil fertility, one of which has remained agricultural while the other has developed commercially.

The population changes due to industrial development and the effects of such development on agriculture, highways and bridges, health facilities, rural finance, taxation, education, transportation and communication, and the rural church are discussed.

Agricultural statistics, 1928, R. E. Stanley (*Jour. Roy. Agr. Soc. England, 89 (1928), pp. 155–177*).—Statistics regarding the acreages, yields, and prices of principal crops, numbers and prices of livestock for England and Wales, and imports of grains, feedstuffs, meats, dairy products, and other agricultural commodities into Great Britain and Northern Ireland for 1927 and 1928 are included.

FOODS—HUMAN NUTRITION

The inorganic constituents of milk, N. C. Wright and J. Papish (*Science, 69 (1929), No. 1777, p. 78*).—This is a brief note stating that samples of cow's milk obtained from various parts of the United States and Great Britain have been subjected to spectrographic analysis for ash constituents with qualitatively identical results. Of the elements previously identified and confirmed by spectrographic analysis, calcium, magnesium, potassium, sodium, and phosphorus were found to be present in relatively large quantities, and iron, copper, zinc, aluminum, and manganese in traces. Elements not previously identified but now found to be present are silicon, boron, titanium, vanadium, rubidium (in all but one sample), lithium, and strontium. Chlorine and iodine could not be identified by the spectrographic method employed, but have been demonstrated by other methods to be present in considerable amounts and traces, respectively.

Attention is called to two samples containing more than usual amounts of copper and zinc, respectively. On reference to the records, the former was found to be a sample of dried milk and the latter to have come from cows pastured in the vicinity of zinc smelters in Franklin, N. J.

Report of an outbreak of alleged ergot poisoning by rye bread in Manchester, M. T. Morgan (*Jour. Hyg. [London], 29 (1929), No. 1, pp. 51–61, fig. 1*).—This is a further discussion of the outbreak of ergot poisoning from rye bread, a brief report of which by Robertson and Ashby has been noted previously (E. S. R., 59, p. 292).

Although it is thought that the amount of ergot in the bread was considerably less than stated in the previous report, the content was sufficiently high to account for the poisoning, particularly since the rye was probably quite fresh.

It is urged that preventive measures be taken in growing and milling rye in order to reduce as far as possible the danger of ergot poisoning.

An appendix contains a report on biological examination of ergot by J. H. Gaddum.

Manufacture and preservation of cranberry products (*Massachusetts Sta. Bul. 247 (1929), p. 325*).—To determine the best methods of preserving cranberry products, about 4,000 cans of cranberry sauce were packed by C. R. Fellers and F. J. Griffiths in various types of tin and glass containers. These were stored at different temperatures and examined periodically.

The best container proved to be the charcoal plate reenameled tin can. The temperature during storage proved to be the important factor in preventing deterioration, the cooler the temperature the more satisfactory the product. It was found that at ordinary temperatures canned cranberry sauce could be kept in good condition for at least a year. Determinations of the content of pectin, acid, and sugar in cranberries picked at different times during the season showed a gradual lowering of jellying power after maturity was reached. There was also great variation among different cranberry varieties.

Utilization of onions by canning (*Massachusetts Sta. Bul. 247 (1929), pp. 325, 326*).—It has been found by C. R. Fellers and F. J. Griffiths that the canning of onions in cans with an inside enamel of zinc oxide prevents discoloration. By the addition of a small amount of organic acid to alter the H-ion concentration of the brine slightly, onions can be sterilized by boiling from 45 to 60 minutes and still remain firm and whole within the can without injury to the flavor.

A possible utilization of cull onions is suggested through drying them and grinding them fine for use in cooking to give an onion flavor.

Outbreak of botulism, Westfield, N. Y., E. CLARK (*Amer. Jour. Pub. Health. 19 (1929), No. 8, pp. 885, 886*).—A brief report of an outbreak of botulism traced to home-canned string beans.

Botulism and home canning (*Jour. Amer. Med. Assoc., 92 (1929), No. 5, p. 395*).—The recent outbreak of botulism noted above was the occasion of this editorial comment, in which the following statements were made:

"Eight cases and four deaths have so far been recorded, and several persons who attended the meal showed symptoms that have not been diagnosed as those of botulism. Heretofore, home canned string beans have caused 39 outbreaks of botulism, far in excess of any other food. In fact, the home canned string beans canned by the cold pack process, particularly in certain parts of the United States, are a potential and continuous menace. Only boiling for a sufficient length of time after removal from the glass jar before the beans are served can make them reasonably safe. The departments of home economics in agricultural colleges, universities, and their extension divisions throughout the country should plan a vigorous educational campaign in order to prevent these preventable deaths. Many of the recipes for home canning of vegetables antedate the present-day knowledge of botulism, and with a few exceptions no effort has been made to correct them. Although it will admittedly be difficult to reach many of those who are particularly endangered by foods inadequately preserved in the home, the public should be told repeatedly that string beans and every nonacid vegetable may be rendered safe either by sterilization for a sufficient time and temperature in a pressure cooker or by drying or by the addition of a 10 per cent brine solution to the cold pack method."

An increase in outbreaks of botulism due to home canned products (*Jour. Amer. Med. Assoc., 92 (1929), No. 22, p. 1868*).—Further evidence of the danger involved in canning nonacid foods by the cold pack process is given in the

statement that since November, 1928, 11 outbreaks of botulism have occurred in various parts of the United States from a variety of home-canned foods, some of which have not been involved heretofore. In these outbreaks there were 35 cases with 21 deaths.

The thirty-third report on food products and the twenty-first report on drug products, 1928, E. M. BAILEY (*Connecticut State Sta. Bul. 307 (1929), pp. 809–849*).—This is the customary annual report of the routine analyses of foods and drugs (E. S. R., 59, p. 891).

The energy and the protein content of foods regularly eaten in a college community, F. G. BENEDICT and A. G. FARR (*New Hampshire Sta. Bul. 242 (1929), pp. 60, fig. 1*).—In this cooperative investigation of the Nutrition Laboratory of the Carnegie Institution and the station, data have been secured on the energy and protein content (1) of several individual foods such as breads, pastry, soups, sandwiches, salads, miscellaneous desserts, ice cream, and candies, (2) of total meals, and (3) of total food consumed per day by an individual. The samples of food were secured for the most part in Boston or Durham. Three types of eating places were represented, (1) commercial restaurants where supposedly standardized meals are served at fixed prices, (2) the college cafeteria where the basis of selection was the duplication of the choice of the operator or the individual immediately preceding the operator in line, and (3) drug stores where sandwiches and ice cream mixtures were obtained. Analyses were also included of meals served on 7 different days at the home economics practice house of the University of New Hampshire.

The oxy-calorimeter was used for determining the energy values of the food samples. A brief description is given of the apparatus and certain modifications in technic which have been made since the apparatus was first described (E. S. R., 54, p. 204). Nitrogen determinations were made on all the samples by the Kjeldahl method. The data, tabulated by classes of materials, include weights of portions, total protein per portion and purchasable for 10 cts., and total calories, calories per gram of air-dry sample, and purchasable for 10 cts.

Ten-ct. orders of bread and butter or muffins and butter averaged from 400 to 500 calories and about 7 or 8 gm. of protein. Extreme variations were 140 calories for sliced bread and 1,070 for corn meal muffins, with corresponding protein values of 2.9 and 15.8 gm. Doughnuts, cookies, and cakes furnished more calories and protein for 10 cts. than the average for unsweetened bread, the average being about 700 calories, with a protein range from 4.2 to 11.5 gm. Sandwiches, while varying widely according to their filling, averaged about 200 calories and from 5 to 10 gm. of protein for 10 cts. Package sandwiches, consisting of crackers with various fillings, averaged about as many calories for 5 cts. as most of the regular sandwiches for 10 cts. The calories for 10 cts. in the salads alone ranged from 75 to 226. Condensed soups (Campbell's) varied considerably in their energy and protein values. The highest protein value for 10 cts. was vegetable-beef soup, 19.2, followed by pea soup, 13.6. Corresponding values for calories were 202 and 260. Ten-ct. portions of pies furnished from 3 to 8 gm. of protein and from 300 to 600 calories. Half-pint servings of ice cream, generally sold for 15 cts., furnished about 500 calories and 7 gm. of protein. One pint of chocolate milk shake furnished from 450 to 500 calories and from 14 to 15 gm. of protein. Candies such as sold in 5-ct. packages averaged about 450 calories for 10 cts.

In the dinners, the calories for 10 cts. ranged from 165 to 410 at the cafeteria and from 145 to 245 at the restaurants, with corresponding protein values of from 4 to 15 and 6 to 11 gm., respectively. The suppers selected at the cafeteria varied in about the same manner as the dinners. Combinations served at night in restaurants ranged from 70 to 385 calories and from 2 to 13 gm. of protein

for 10 cts. The practice house meals averaged 2,450 calories and 61 gm. of protein per person per day.

A comparison of the energy content and the weight of the air-dry matter of the different samples tested showed that although the ratios between the two for individual foods varied widely it was remarkably constant for mixed meals at about 5 calories per gram of air-dry matter. "In view of the high digestibility of the foods consumed by man, it is clear that by determining the air-dry weight in grams of a mixture of foods and by multiplying this weight by the factor 5, one can estimate the total calories in a mixed meal with a relatively high degree of accuracy. This procedure does away with the necessity for using either the bomb or the oxy-calorimeter, and although it can not have the scientific accuracy of either of these rigidly tested means of energy measurement, nevertheless we believe that as a procedure in the hospital and in the dietetic laboratory it is of great practical value."

Present practices of Massachusetts elementary schools with regard to school feeding and transportation and their effects upon health of pupils (*Massachusetts Sta. Bul. 247 (1929), p. 324*).—In this investigation, which is being conducted by E. S. Davies and C. B. Church in the elementary schools of 237 Massachusetts towns having a population of less than 5,000, information has been obtained from conferences with school superintendents, visits to the teachers, personal inspection of food services, and actual experience in using transportation facilities. It was found that the number of schools in which provision is made for serving a hot food or drink at noon throughout the school year is almost negligible, and that the number providing such service during the cold weather is less than half the total number of schools. There is practically no mid-morning milk service. Transportation is usually provided only along the main highways, the children walking to assembling points at which shelter is seldom provided. Lack of careful planning of routes results in prolonging the length of time the children are away from home.

Food habits of Utah farm families, A. P. Brown (*Utah Sta. Bul. 213 (1929), pp. 20*).—This report includes the findings in a preliminary investigation of the quantities and varieties of foods for home use grown on farms in different parts of the State as noted from a progress report (E. S. R., 61, p. 87), and in the more detailed quantitative investigation of food consumption and adequacy as determined by yearly records kept under close supervision. A total of 43 of these records were secured, including records from 16 families of the preliminary study.

Twenty-three different vegetables and 13 cultivated fruits were reportd as furnished by the farm. Potatoes constituted 55 per cent and leafy vegetables 6.5 per cent of the total vegetables. The average number of eggs was 3 doz. per family of 6 per week. Whole milk averaged 1.1 qt. per day for each child between the ages of 1 and 18 years, but fell somewhat below the standard of 1 qt. per individual. Butter averaged 95.9 lbs. per family per year. Buttermilk, skim milk, and cheese were used sparingly. Pork constituted 49.8 per cent of the total meat, beef 20.3, poultry 13.8, lamb and mutton 7.9, fish and miscellaneous lunch meats 6.5, and veal 1.7 per cent. Whole wheat and graham flours comprised only 9.7 per cent of all the flour used. Granulated and powdered sugar averaged 360.31 lbs. per family, honey 47.85, sirup 17.5, molasses 11.15, candy 6.53, and brown sugar 4.5 lbs. The fats consisted chiefly of butter and lard, the latter averaging 58.6 lbs. per family.

The distribution of foods by groups expressed in ounces per adult male unit per day was as follows: Meat and fish 3.68 oz., eggs 0.83 egg, whole milk 21.67 oz., cream and cheese 1.63, butter 1.22, fruit 9.12, vegetables 13.9, and cereal products 7.62 oz. Individual diets were analyzed for energy, protein, calcium,

phosphorus, and iron by the Hawley short method and compared in minimum, maximum, and average values with the Sherman standards. The average values exceeded the standards for everything but phosphorus and iron, which were 93.9 and 71.2 per cent of the standards, respectively. The average distribution of calories among the various food groups showed rather low values for meat, eggs, and cheese, fats, vegetables, and fruits, high for milk and cream, and somewhat high for sweets and cereals. It is thought that the diets might be improved by a greater use of lean meat, fruits and vegetables, and whole grain products. No marked differences were apparent in the nutritive value of the average diets from different sections of the State.

Effect of high cereal diets on the growth of infants, V. B. APPLETON (*Amer. Jour. Diseases Children, 37 (1929), No. 2, pp. 284–295, fig. 1*).—Data are summarized and discussed on the weights of 1,200 Japanese and 869 Filipino infants of both sexes by months from 1 to 24, inclusive, and on the gains in weight by month, quarter, and half year for the first 12 months. These infants and 379 native Hawaiian infants were also examined for skeletal development. The diet of both the Japanese and Filipinos is high in rice and lacking in milk, but that of the Japanese contains more vegetables than that of the Filipinos. The infants as a rule are breast fed for a long period.

Before the age of 6 months the average weights of both male and female Japanese infants were nearly the same as the average weight of infants of European ancestry, but after 6 months they were considerably less. The average weight of the Filipino infants was slightly less than that of the Japanese at the age of 1 month, and the difference became greater with increasing age. The flattening of the growth curves after 6 months is thought to be characteristic of the growth of races whose diet contains abundant cereals and no milk.

Rickets was extremely rare among the children, but there was a tendency to poor calcification of the shafts of the ribs. It is noted that this condition is even more striking in Chinese children. It is suggested that this may be due to an actual deficiency of calcium, possibly the result of rapidly successive pregnancies. The eruption of deciduous teeth occurred early in both Japanese and Filipino infants, particularly the former.

The curd and the buffer in infant feeding, J. BRENNEMANN (*Jour. Amer. Med. Assoc., 92 (1929), No. 5, pp. 364–366*).—In this progress report on an investigation which is being carried on at the Children's Memorial Hospital, Chicago, Ill., to determine the validity of the theories which have been advanced as to the cause of superiority of acid milk over sweet milk in infant feeding, a comparison is made of the general results obtained in the feeding of infants up to 18 months of age with lactic acid milk, prepared with evaporated milk according to the formulas proposed by Marriott (E. S. R., 57, p. 893), and with similar modifications with the lactic acid omitted. In all 67 observations were made with the lactic acid milk and 61 with the sweet milk, the babies sometimes being left on the acid-free mixtures for about three weeks.

Aside from the fact that in general the acid milk was taken better than the nonacid, there was no appreciable difference in the reaction to the two forms of milk. The author concludes that the acid plays a minor part and the attenuation of the curd in evaporated milk a major part in the success of such mixtures. It is emphasized that this investigation was conducted during the winter and spring when parenteral infections, particularly those of the respiratory tract, were prevalent, and that the results with this form of milk may not be the same in the summer when the incidence of diarrheal disorders is greater.

Dental defects in relation to child nutrition, E. S. DAVIES (*Jour. Home Econ., 21 (1929), No. 2, pp. 106–108*).—As an outcome of experience in evaluat-

ing the data on dental conditions in the survey of the food habits and health of rural school children in Massachusetts (E. S. R., 59, p. 790), the author presents suggestions for evaluating such data.

The data should first be separated into those on deciduous and those on permanent teeth. The percentages of permanent teeth should be calculated on the number erupted and not on the normal adult number. The data should be classified according to types of teeth—incisors, canines, bicuspids, and molars, and to facilitate statistical treatment one type should be selected for comparison, preferably the 6-year molars. In considering caries from the point of view of nutrition, both filled and unfilled cavities and the extraction of permanent teeth should be included. Among children of elementary school age fissnres and pits shonld be included. Comparisons should not be made between gronps of cbildren having had dental care and those who have not. Race and age should be considered, but sex is thought not to be of prime importance in evaluating the teeth of children from 6 to 16 years of age.

It is emphasized in conclusion that no one of the indices of health can be used to the exclusion of others in judging the nutritional status of children, but that when dental conditions are bad the search for the cause may well begin in a study of the content of calcium and vitamins A and C in the diet.

The influence of the amount of food consnmed on the growth of an animal, M. C. House (*Jour. Home Econ., 21 (1929), No. 1, pp. 51–53*).—Data on the food consumption and gains in weight of 78 rats (40 males and 38 females) maintained for eight weeks on the same basal diet, with constant qnantities of tomato juice as the source of vitamin B, have been studied statistically to determine the relationship between initial weight and final weight, initial weight and average food intake, and final weight and average food intake, with results indicating that the correlation between initial weight and final weight and final weight and average food intake are of little significance, but that there is a significant correlation between the final weight and average food intake.

In the opinion of the author, "the data herein presented emphasize the advisability of keeping accurate food records and the necessity of taking into account the amounts of food eaten when comparing the gains in weight of experimental animals."

The fluctuations of the capillary blood sugar in normal young men during a twenty-four hour period (including a discussion of the effect of sleep and of mild exercise), H. C. Trimble and S. J. Maddock (*Jour. Biol. Chem., 81 (1929), No. 3, pp. 595–611*).—Data are reported on the total reducing sugars as determined by the Folin micro method in the capillary blood of nine normal young men at hourly intervals over a period of 24 hours. In many cases sleep was not interrupted by the taking of the samples.

In all of the subjects the concentration of sugar was maintained at a very constant level while at rest in bed. Although the levels varied slightly with the individuals, the average value was approximately the same as the average of a group of 84 young men in postabsorptive condition. In one of the subjects an average value of 101±4.7 mg. per cent was obtained for seven observations made between midnight and morning while the subject was carrying on laboratory measurements, and an average valne of 101±2.5 mg. for six observations made during sleep.

It is concluded from these observations that sleep does not cause a significant change in blood sugar concentration. There was some indication that after mixed meals the capillary blood sugar returned to fasting levels somewhat more slowly than has been reported by others after the ingestion of pure carbohydrate. No significant change in sugar resulted from various forms of mild exercise.

Estimation of vitamin A in cod-liver oil (*Lancet [London], 1928, I, No. 3, pp. 148–150*).—This is the report to the League of Nations Health Organization of a comparative study organized by the accessory food factors committee of Great Britain to test the validity of the antimony trichloride or arsenic trichloride color tests in comparison with the biological method. The colorimetric tests were conducted by O. Rosenheim and the biological tests by E. Mellanby, J. C. Drummond, V. H. Mottram and G. Hartwell, K. M. Soames and J. Leigh-Clare, and by [E.] Poulsson in Norway. A general method for the biological determinations was adopted by four of these laboratories, but not carried out in every respect. This made it impossible to make a quantitatively accurate comparison, but the oils were graded qualitatively by the customary + signs. As thus graded there was fairly good agreement in the reports from the different laboratories and between the grading from biological and colorimetric tests.

The committee concluded that the results obtained by the colorimetric method are consistent with those derived from the biological tests, but that before conclusions can be drawn as to the general validity of the colorimetric method, tests should be made with vitamin A-containing substances other than cod-liver oil.

The report includes an appendix in which are listed the basal vitamin A-free diets used in the different laboratories.

The relative content of the fat-soluble vitamins A and D in a series of cod-liver oils, J. L. Leigh-Clare and K. M. Soames (*Lancet [London], 1928, I, No. 3, pp. 150–152*).—The seven cod-liver oils used in the investigation noted above have been tested for their content of vitamin D by three different methods: (1) The increase in bone calcification occurring after small doses of the oils had been administered to young rats on the McCollum rickets-producing diet 3143, (2) the ash content of the bones of rats receiving diet 3143 modified by the addition of 20 per cent wheat embryo to serve as the source of vitamin A and with corresponding reduction of the casein and starch, and (3) the increase in weight in the rats used in group 2. In all cases negative and positive controls were included for comparison.

The results obtained by the different methods, while showing general agreement, demonstrated a relatively low degree of accuracy for all the methods in that the variations among the animals on the same dosage sometimes were as great as those existing between the averages calculated for rats in the different groups. No correlation was found between the content of vitamins A and D in the series of oils. This lack of parallelism was thought to be due in part to the fact that vitamin A is less stable than vitamin D, and consequently is destroyed to a greater extent by methods of preparation and storage involving heat and oxidation.

The authors criticize the biological method of testing cod-liver oil given in the United States Pharmacopoeia on the ground that it determines vitamin A only, while in their opinion "the medicinal worth of cod-liver oil depends more upon its antirachitic value than upon its content of vitamin A, for the latter is readily and more conveniently obtained from foodstuffs."

Relative content of water-soluble vitamin B in thirty oriental foods, H. E. Sherman (*Philippine Jour. Sci., 38 (1929), No. 1, pp. 9–36, figs. 37*).—Inasmuch as the foods used in this study were, with few exceptions, cooked 40 minutes in an autoclave at 15 lbs. pressure and dried in the air below 60° C., the results can be interpreted in the present knowledge of the components of vitamin B as indicating the presence of vitamin G rather than vitamin F of the B complex.

Mice and white rats were used as the experimental animals and the material to be tested was, for the most part, incorporated in the basal vitamin B-free ration from the start. Among the materials tested, many of which are unknown outside the Orient, the Chinese persimmon (*Diospyros kaki*), the water chestnut (*Eleocaris tuberosa*), fermented rice, and locust seed (*Robinia pseudoacacia*) were reported to be lacking in vitamin B; mung beans, yellow and green soybeans and their sprouts, and soybean curd rich in vitamin B; and the chico and papaya to contain it but in relatively small amounts.

Rice polishings as a source of vitamin B, H. E. Munsell (*Jour. Home Econ., 21 (1929), No. 2, pp. 124–129, figs. 4*).—This preliminary report on the value of rice polishings as a source of vitamins F and G also includes data on the relative amounts of these vitamins in dried powdered brewery yeast.

Five rats on a vitamin B-free diet were fed 0, 0.06, 0.12, 0.25, and 0.50 gm., respectively, of dried yeast six days a week. The rat receiving no yeast declined and died, but without symptoms of polyneuritis. The other four gained in weight in proportion to the amount of yeast fed. A second series received the same basal diet with the exception that 10 per cent of autoclaved yeast, a good source of vitamin G free from vitamin F, was substituted for an equivalent amount of starch. The rat on the basal diet alone increased in weight during the first week and then declined and died, showing moderate symptoms of polyneuritis. The others gained in weight proportional to the amount of yeast eaten, the gains being greater than in the first series. This indicates that growth was proportional to the content of vitamin F since vitamin G was supplied in abundance, and that vitamin F must have been the limiting factor when yeast was used as the source of both F and G.

On repeating the experiments with rice polishings, first as a source of vitamin B and then of F, it was found that vitamin G rather than F was the first limiting factor. On 0.25 and 0.5 gm. of rice polishings as the sole source of vitamin B there was no growth, pellagra-like symptoms developing during the twelfth and seventeenth weeks, respectively, and the rat receiving the smaller amount of rice polishings died. Rats on 1 and 2 gm. of rice polishings as the sole source of vitamin B made significant gains in weight. On supplementing the basal diet with 0.5 gm. of autoclaved yeast daily there was growth, even on the smallest amount of rice polishings fed. If it concluded that rice polishings contain very little vitamin G, but are a good source of vitamin F.

The germinating power, nutrients, and vitamin B in rice kept for four years in carbon dioxide-filled and air-tight containers [trans. title], M. Kondô, S. Matsushima, and T. Okamura (*Imp. Acad* [*Japan*], *Proc., 5 (1929), No. 3, pp. 159, 160*).—Rice kept for four years in zinc containers, either air-tight or filled with carbon dioxide, was found to have retained all of its germinating power and nutrients and to be as rich in vitamin B (antineuritic) as fresh rice. Samples stored in paper bags for the same length of time lost all their germinating power and changed considerably in composition.

The physiology of vitamins.—V, Cutaneous manifestations related to a deficiency of the vitamin B complex, G. R. Cowgill, C. J. Stucky, and W. B. Rose (*Arch. Path., 7 (1929), No. 2, pp. 197–203, pls. 2*).—In this continuation of the series of studies noted previously (E. S. R., 56, p. 795), cutaneous lesions observed in six dogs subsisting for long periods on artificial diets adequate except for the vitamin B complex are described, with colored reproductions of the lesions in the early and late stages. The round or slightly oval lesions were apparently symmetrically placed, involving particularly the bony prominences on the flexor and extensor surfaces of the fore and hind limbs. In the

early stages they were slightly elevated and pink in color. Gradually the elevated zones were sloughed off, leaving sharply punched-out ulcers.

In two of the animals the sores developed after approximately a month on the deficient diet and healed promptly following treatment with a concentrated preparation of vitamin B. One of these animals was again placed on the deficient diet and again developed sores in about 39 days. Another dog was cured in the preulcerative stages of the lesions. Three died suddenly before the vitamin treatment had begun to take effect.

A possible correlation is suggested between these lesions and bedsores which develop in chronic invalids upon hospital diet. "Our observations suggest that more attention should be paid to the content of vitamin B in the diets used in such cases. Concentrates of vitamin B are now available commercially. Such preparations added to the routine diet may possibly prove of therapeutic value, and will probably improve the patient's appetitie. In this way, the general nutritive state of the patient may be improved and healing favored."

Vitamin C in Idaho potatoes (*Idaho Sta. Bul. 164 (1929), p. 32*).—In this preliminary report of a study of the effect of storage upon the vitamin C content of the Russett Burbank potato of Idaho, it is noted that new potatoes appear to be somewhat richer than mature potatoes in vitamin C.

The influence of activated ergosterol on the development of young animals [trans. title], F. Goebel (*Compt. Rend. Soc. Biol. [Paris], 100 (1929), No. 13, pp. 1155, 1156*).—A brief summary is given of data indicating that vitamin D in the form of irradiated ergosterol is capable of promoting the growth of rats not only on a rachitic diet but also on a normal diet. Growth was stimulated by irradiated ergosterol in thyroidectomized rats, but not in rats deprived of their thymus glands.

Contribution to the study of the physical and biological properties of irradiated sterols [trans. title], R. Fabre and H. Simonnet (*Bul. Soc. Chim. Biol., 10 (1928), No. 8, pp. 1100–1110, figs. 2*).—Essentially noted from another source (E. S. R., 61, p. 195).

The alleged toxic action of accessory food factors, J. C. Hoyle (*Lancet [London], 1929, I, No. 14, pp. 734–736*).—This is a critical review and discussion of the literature on the subject of the alleged toxic action of an excess of vitamins, chiefly vitamin D.

A list of 55 references to the literature is appended.

The etiology of beriberi, S. Matsumura et al. (*Jour. Amer. Med. Assoc., 92 (1929) No. 16, pp. 1325–1327*).—This contribution from the department of hygiene, Government University of Medicine of Chiba, Japan, summarizes briefly certain facts about beriberi not entirely explainable on the vitamin hypothesis and data from pigeon feeding experiments and human beriberi, leading to the conclusion that an organism resembling *Bacillus coli-communior* is responsible for beriberi and that a deficient diet such as polished rice is only a contributing factor through lowering the resistance. The organism, which has been named *B. beriberi*, has been isolated from the feces of polyneuritic pigeons and of a considerable proportion of human beings suffering from beriberi, but has not been found in normal pigeons or persons.

When cultures of the organism are fed to pigeons on polished rice, the organism is implanted and symptoms of polyneuritis appear. The serum of such pigeons, as well as from human cases of beriberi, is said to contain potent specific agglutinins for the beriberi bacillus.

Quartz lamp therapy in human rickets and rachitic spasmophilia, H. J. Gerstenberger and J. I. Hartman (*Jour. Amer. Med. Assoc., 92 (1929), No. 5, pp. 367, 368*).—Irradiation of the entire body once a week in doses equivalent to

1 erythema unit (Rost and Keller) for colored infants, and slightly less for white infants, has been found to bring about healing of rickets in practically the same time required for the heavier doses at present in general use.

TEXTILES AND CLOTHING

Some properties of the cell-wall of cotton-hairs, N. W. Barritt (*Ann. Appl. Biol., 16 (1929), No. 3, pp. 438–443, figs. 3*).—Microscopic studies and strength tests on several cottons showed that the cell wall of the living cotton hair (fiber) is under tension and its diameter is unaffected by osmotic pressure or the death of the cell. Increase of diameter of the uncollapsed hair by swelling in caustic soda seemed to vary inversely as the diameter of the hair in the case of fine cottons but apparently does not occur with coarse cottons. The diameter of the uncollapsed cotton hair evidently varies inversely as the intrinsic strength of the collapsed hair.

The influence of laundering on some cotton and linen fabrics, M. Griffith, T. Sprague, V. Berg, and R. Edgar (*Iowa State Col. Jour. Sci., 3 (1929), No. 3, pp. 215–225, fig. 6*).—This report presents data, without discussion, on a study of the effect of repeated laundering upon the thickness, weight, content of inorganic material, and dry and wet breaking strengths of unbleached, bleached, and mercerized cotton sheeting; unbleached and bleached linen sheeting; linen-finished and permanent-finished cotton shirting; silver bleached and bleached linen table damasks; and mercerized and schreinerized and permanent finished and schreinerized cotton table damasks. The effect of moist heat at 120° C. and 20 lbs. pressure on the dry warp breaking strength of unbleached, bleached, and mercerized cotton sheetings and bleached linen sheetings was also studied because of the sterilization of sheetings in hospital practice. The unsoiled fabrics were laundered in 2-yd. lengths 150, 200, and 1,100 times at the college laundry by methods similar to those in commercial practice. The data are reported in tables and graphs.

The detergent action of soap, F. H. Rhodes and S. W. Brainard (*Indus. and Engin. Chem., 21 (1929), No. 1, pp. 60–68, figs. 12*).—Methods for the direct determination of the cleansing power of soap are reviewed critically, and a new method is described which is said to meet the following requirements: "(1) It measures detergent power directly and not some other property of the cleansing agent which may or may not be related to detergent power; (2) the measurements are obtained under conditions which approximate those of ordinary laundry practice; (3) the results are duplicatable and are obtained under controlled conditions; (4) the results are in numerical units which permit quantitative comparison."

In making a complete washing test to determine the detergent action of a soap, the cloth to be used is freed from sizing, dried, and its brightness determined by the use of an integrating photometer. The sample is then soiled by a standard process, dried, and aged, and the brightness of the soiled fabric is measured. The cloth is then put through a series of washing cycles with brightness determinations after each cycle. Each step of the procedure has been carefully standardized, and a formula has been devised for translating the experimental data of the test into numerical indices which express the detergent characteristics of the soaps used.

HOME MANAGEMENT AND EQUIPMENT

Electric household refrigeration, W. T. Ackerman (*New Hampshire Sta. Bul. 244 (1929), pp. 24, figs. 10*).—The results of tests of the merits of electric refrigeration in the home made on six farms are reported, which included

studies of separate house units and refrigeration in combination with dairy cold storage. The equipment included commercially built single cabinet units, common commercially built refrigerators converted to electric operation, and homemade refrigerators converted to electric operation. The refrigerators varied in size from 5.5 to 30 cu. ft. of food storage space. The combination dairy and household storage represented the lowest investment. Current consumption on five standard type refrigerators averaged 41 kw. hours per month. The average maximum consumption was 67 and the average minimum consumption 13 kw. hours per month. The current consumption for household refrigerators varied from 0.0016 to 0.008 kw. hours per cubic foot of total box capacity. Household storage operated in combination with the dairy required one-third the power used by standard types. The average time of operation of compressor units was 19 per cent of the total elapsed time. Total annual costs for using ice averaged $41.63 per year. The average annual cost of operation of the electric refrigeration was $20.97. Distinctly superior refrigeration was obtained from the electric method.

Electrically operated refrigerators for farm use (*Nebraska Sta. Rpt. [1928], p. 10*).—Observations of electrically operated refrigerators showed a range of from 0.1471 kw. hour per day per cubic foot of food space to 0.3846 kw. hour per day per cubic foot, depending on the time of year, location, usage, and the like.

MISCELLANEOUS

Work and progress of the [Idaho] Agricultural Experiment Station for the year ending December 31, 1928, C. W. HUNGERFORD (*Idaho Sta. Bul. 164 (1929), pp. 45*).—This contains the organization list, a report of the vice director, and financial statements for the Federal funds for the fiscal year ended June 30, 1928, and for the remaining funds for the fiscal year ended December 31, 1928. The experimental work reported not previously noted is for the most part abstracted elsewhere in this issue.

The Forty-first Annual Report of the Maryland Agricultural Experiment Station, [1928], H. J. PATTERSON (*Maryland Sta. Rpt. 1928, pp. XXVIII+198+[2], figs. 44*).—This contains the organization list, a report by the director on the work and publications of the station, a financial statement for the fiscal year ended June 30, 1928, and reprints of Bulletins 291–298, all of which have been previously noted. The experimental work reported is for the most part abstracted elsewhere in this issue.

Biennial Report of the Massachusetts Agricultural Experiment Station, 1927 and 1928, F. J. SIEVERS ET AL. (*Massachusetts Sta. Bul. 247 (1929), pp. 295–349*).—This contains the organization list, an introduction by the director, and departmental reports. The experimental work not previously noted is for the most part abstracted elsewhere in this issue.

Forty-second Annual Report of [Nebraska Station, 1928], [W. W. BURR] (*Nebraska Sta. Rpt. [1928], pp. 50*).—This contains the organization list, a report of the work of the station, and a financial statement for the fiscal year ended June 30, 1928. The experimental work not previously reported is for the most part abstracted elsewhere in this issue.

Agricultural experimentation in the field of plant culture in Denmark, its organization and methods [trans. title], H. WACHS (*Wiss. Arch. Landw., Abt. A, Pflanzenbau, 1 (1929), No. 3, pp. 556–641*).—An extended account of progress in this field, including a discussion of some of the results which have been obtained.

Publications available for free distribution (*Idaho Sta. Circ. 54 (1929), pp. 4*).—The available station and extension publications are listed.

NOTES

Kansas College and Station.—James Walter McColloch, professor of entomology and staple crop insect investigator since 1925, died November 11 at the age of 40 years.

Prof. McColloch was a native of Kansas, a graduate of the college in 1912, with the M. S. degree in 1923, and had spent his entire time since graduation at the institution in instruction and research. He had worked especially on the chinch bug, Hessian fly, wireworms, white grubs, and other subterranean insects. He had fostered regional meetings of entomologists and the interchange of advance information and findings, was a member of many societies, and had done a considerable amount of editorial work on a number of publications. In the words of a tribute by G. A. Dean, head of the department, in a recent issue of the *Kansas Industrialist*, "the loss of his fellowship, experience, and resourcefulness is incalculable. In his untimely death entomology has suffered a real loss, and his associates and coworkers in the United States, Canada, and many foreign countries will feel intimately the loss of his fine personality and stimulating influence."

Massachusetts College.—William R. Hart, professor of agricultural education from 1907 until his retirement in 1923, died at Santa Barbara, Calif., October 20 at the age of 76 years.

Prof. Hart was a native of Iowa, studying in turn at Howe's Academy and Teachers' Training School at Mount Pleasant, Iowa, Iowa Wesleyan University, the Iowa State Law School, and the University of Nebraska. He received the B. A. degree from the last-named institution in 1896 and that of M. A. in 1900. He had had long and varied educational experience, including the superintendency of schools at Holdrege, Nebr., from 1887 to 1894 and teacher of psychology and pedagogy in the State Normal School at Peru, Nebr., from 1901 to 1907. His principal contribution to agricultural education, however, was in Massachusetts, where he organized and developed the department and helped to train many prospective teachers going out from the college.

Michigan Station.—The resignation is noted of R. Wayne Newton, research associate in economics, effective November 1.

Missouri University and Station.—Dr. Henry Daggett Hooker, associate professor of horticulture since 1920, was accidentally killed on October 26 at the age of 37 years.

Dr. Hooker was born in Brooklyn, N. Y., graduating from Yale University in 1912 and receiving the M. A. degree in 1913 and that of Ph. D. in 1915 in plant physiology and physiological chemistry. He had also studied at Strasbourg in 1912 and 1913.

At the outbreak of the war Dr. Hooker was instructor in botany in Yale. In 1918 he served as assistant physiologist in the gas defense organization of the U. S. Bureau of Mines and later as a lieutenant in the U. S. Chemical Warfare Service and a major of the Chemical Warfare Service of the Missouri National Guard. Coming to the university and station in 1919, he took up plant physiological and biochemical investigations in horticulture. Among other problems he worked on hardiness, nitrogen fertilization, fruit-bud formation, carbohydrate metabolism, and biennial bearing in apples and other fruits.

His work was highly regarded and had brought him much recognition. He was a fellow of the American Association for the Advancement of Science, chairman from 1924 to 1926 of the Missouri Section of the American Chemical Society, and a member of the division of biology and agriculture of the National Research Council. He was the author of numerous technical papers reporting the results of his station work, as well as of more popular writings, and collaborated with V. R. Gardner and F. C. Bradford in two books, Fundamentals of Fruit Production (1922) and Orcharding (1927).

New Hampshire University and Station.—John Chester McNutt, head of the department of animal husbandry since 1921, died October 12 at the age of 48 years. He was a native of Ohio and graduated from the Ohio State University in 1907. Subsequently he had been assistant professor of animal husbandry in the New Hampshire College from 1908 to 1910, professor of animal husbandry and dairying in the North Carolina College from 1910 to 1916, and professor of animal husbandry in the Massachusetts College from 1916 to 1921.

New York State Station.—Frank Henry Hall, editor and librarian of the station from 1897 to 1919, vice director from 1913 to 1919, and associate in research in horticulture since 1922, died October 17 at the age of 63 years. He was a native of Michigan, a graduate of the Michigan College in 1888, and instructor in mathematics in that institution from 1888 to 1890. From 1893 to 1897 he was connected with the library and the editorial work of the U. S. D. A. Office of Experiment Stations.

At the station he assembled and organized the library and developed a simple system of cataloguing which was in use for many years. His main work, however, was as an editor. He was the first station editor to be appointed in this country, and made an enviable record through the high standards sought and maintained in his publications. His introduction of the popular bulletin series was among his notable innovations. In the words of a recent tribute from the station, "these bulletins were unique in that they marked one of the first efforts on the part of any experiment station to put the results of its experiments in a form designed especially to appeal to their farmer clientele. Mr. Hall possessed genuine skill in accomplishing this purpose, and without doubt his series of popular bulletins played an important part in gaining recognition for the station and its work and rendered a real service to New York farmers."

For many years he also participated in the farmers' institutes of the State. He developed much aptitude for this work, and came to be in great demand as a popular lecturer at such gatherings.

Mr. Hall's horticultural work had been largely with vegetables and was very highly regarded. Shortly before his death some of his results were embodied in the comprehensive monograph entitled The Peas of New York (E. S. R., 61, p. 640).

Rhode Island Station.—H. F. A. North has been appointed assistant agronomist, beginning November 1, to fill the vacancy caused by the resignation of Eric S. Garner, agrostologist.

Washington College and Station.—The new dairy barn, which accommodates 60 cows with young stock, has been completed at an approximate cost of $20,000.

Harry J. Jensen, horticulturist at the Irrigation Substation at Prosser has resigned, effective January 1, 1930, to accept a commercial position. L. L. Claypool has been appointed assistant horticulturist, beginning February 1.

INDEX OF NAMES

Aamodt, O. S., 238.
Abbott, C. E., 645.
Abbott, E. V., 539.
Abdel, Aziz Eff. el Ghawabi, 657.
Abegg, F. A., 22.
Abel, T., 687.
Abell, M. F., 180, 885.
Abell, T. H., 37.
Abella, R., 269.
Ableson, M., 268.
Abramson, H., 392.
Ackerman, A. J., 756.
Ackerman, W. T., 178, 897.
Ackerson, C. W., 63, 862.
Ackert, J. E., 474, 543.
Adam, A., 95.
Adams, F., 381, 877.
Adams, J. R., 813.
Adams, R., 609.
Adams, W. L., 558.
Addington, L. H., 262.
Adolf, M. S., 409.
Aereboe, F., 289, 688.
Agee, J. H., 616.
Aggarwala, A. C., 671.
Aginsky, L. N., 681.
Agnew, M. A., 290.
Ainslie, C. N., 360.
Aitchison, D. A. D., 267.
Ajon, G., 529.
Akazawa, S., 569.
Akenhead, D., 528.
Albert, A. R., 129.
Alder, B., 63, 764.
Alexander, E. R., 290.
Alexander, L. J., 147.
Alexander, L. M., 257, 291.
Alexander, W. H., 416.
Alexander, W. P., 84.
Alexandrov, W. G., 425, 628, 816.
Allan, H. H., 581.
Allen, A., 514.
Allen, E., 631, 632.
Allen, E. W., 96, 99, 699, 700, 701, 702, 703, 704, 705, 706, 707.
Allen, F. L., 299.
Allen, F. W., 737.
Allen, H. R., 120.
Allen, J. W., 100.
Allen, O. E., 599.
Allen, O. N., 127.
Allen, W., 884.
Allison, F. E., 815.
Allison, J. B., 656.
Allison, R. V., 198.
Allred, C. E., 888.
Alonso, R., 800.
Alp, H. H., 179.
Alpatov, W. W., 358.
Alsberg, C. L., 688.
Alston, R. A., 648.
Alter, D., 614.
Amberg, S., 711.
Ames, C. T., 433, 443, 498.
Amick, C. A., 311.
Amos, J., 348.
Amoss, H. L., 674.
Anderegg, L. T., 568.
Anderson, A., 129, 518.
Anderson, A. E., 289.
Anderson, B. M., 159, 257.
Anderson, D. E., 292.
Anderson, H. W., 233.
Anderson, J. A., 800.
Anderson, M. S., 419.
Anderson, N., 687.
Anderson, P. J., 184, 382, 637.
Anderson, W. E., 694.
Anderson, W. S., 258, 433, 438, 442, 498.
Anderson, W. T., jr., 697.
Anderssen, F. G., 836, 816.
Andreev, F. P., 472.
Andrewes, C. H., 469.
Andrews, A., 599.
Andrews, F. M., 28, 887.
Andrews, J., 269.
Andrews, J. C., 107.
Andrus, C. G., 618.
Angell, H. R., 147, 845, 537.
Anthony, H. E., 542.
Anthony, R. D., 281.
Antipov-Karataev, I., 508.
Aoki, M., 672.
Apollonow, A., 418.
App, F., 285.
Appel, G. O., 584, 651.
Appel, O., 846, 582.
Appleman, C. O., 224.
Appleton, V. B., 892.
Arant, F. S., 458.
Archibald, J. G., 866.
Archibald, R. G., 843, 844.
Aristov, M. T., 854.
Arkhangel'skiĭ, S. A., 472.
Arkwright, J. A., 469.
Arland, A., 300.
Armenag Eff. Bedevian, 826.
Armstrong, H. E., 801, 884.
Arnquist, I., 500.
Arny, A. C., 331.
Arrhenius, O., 827.
Artschwager, E., 628.
Asami, Y., 230.
Ashby, R. C., 579, 886.
Ashley, J. N., 202.
Ashton, L. O., 587.
Ashworth, J. T., 547.
Atherton, I. K., 571.
Atienza, M., 651.
Atkinson, A., 222.
Atkinson, D. J., 255.
Atwater, W. O., 2, 701.
Atwood, H., 668, 863, 864.
Austin, M., 354.
Averell, J. L., 646.
Ayers, T. T., 540.
Ayres, Q. C., 275.
Ayyer, T. V. R., 452.

Babb, M. F., 599.
Babcock, E. B., 326, 336.
Bach, F., 527.
Bach, W. J., 237.
Bacharach, A. L., 695.
Bacon, C. A., 276.
Bacon, C. W., 333.
Bacon, S. R., 16.
Baels, H., 691.
Bailey, A. A., 48.
Bailey, C. H., 338, 586.
Bailey, E. M., 355, 558, 890
Bailey, H. G., 734.
Bailey, J. E., 86.
Bailey, J. S., 832.
Bailey, L. H., 579.
Bain, H. F., 244.
Bainer, R., 686.
Baker, C. F., 500.
Baker, F. E., 546.
Baker, G. J., 258.
Baker, G. L., 610.
Baker, H. J., 789.
Baker, H. N., 257.
Baker, H. R., 97, 499, 675
Baker, L. C., 709.
Baker, O. E., 284, 288, 487
Bakewell, R., 400.

Balbach, P., 782.
Balch, W. B., 290.
Balderston, R. W., 285.
Baldauf, W. V., 56.
Baldwin, I. L., 127.
Ball, W. S., 598.
Ballou, C. H., 555.
Ballou, F. H., 449, 685.
Ballow, E. B., 186.
Balls, W. L., 826.
Banerji, I., 629.
Banfield, W. M., 148.
Bangs, N. H., 814.
Barbacki, S., 226.
Barber, G. W., 852.
Barbier, G., 206.
Barden, R. D., 688.
Barenberg, L. H., 392.
Barger, G., 201.
Barger, J. W., 488, 690.
Barger, W. R., 245.
Barlow, W., 801.
Barnard, J. E., 469.
Barnes, B., 513.
Barnes, B. F., 396.
Barnes, D. F., 547.
Barnes, E. E., 418.
Barnes, H. F., 854.
Barnett, C. R., 102, 103.
Barnett, R. J., 396.
Barr, H. T., 397.
Barrett, A. O., 530.
Barrett, O. W., 198.
Barritt, N. W., 897.
Barron, W. E., 614.
Barthel, C., 369.
Bartholomew, R. P., 319, 339.
Bartlett, J. M., 226, 228, 693.
Bartlett, J. W., 561.
Bartlett, S., 264.
Baskett, R. G., 667.
Basset, J., 874.
Bassett, C. F., 759.
Batchelor, L. D., 97.
Bates, C. G., 142, 236.
Bates, G. E., 617.
Bauche, J., 678.
Baudet, E. A. R. F., 874.
Bauer, F. C., 17, 423, 714, 809.
Bauer, J. T., 372.
Bauer, K. H., 610, 630.
Baumgartner, W. H., 397.
Bäurle, A., 501.
Bavendamm, W., 843.
Baver, L. D., 417, 418.
Bayles, B. B., 223.
Baylis, H. A., 872.
Beach, B. A., 165, 178.
Beach, J. R., 64, 273, 474.
Beadle, G. W., 216.
Beal, J. A., 767.
Beal, W. H., 96, 699.
Bean, L. H., 284.
Beane, C. L., 884.
Bear, F. E., 812.
Beard, H. H., 590.
Beattie, J. H., 449.
Beaudette, F. R., 451, 578, 676, 769, 770.
Beaumont, A. B., 316, 812, 814, 823.
Beaumont, J. H., 725, 734.
Beck, P. G., 482.
Becker, E. R., 373.
Becker, R. B., 257, 765.
Beckett, S. H., 378.
Beckwith, C. S., 739, 747.
Beckwith, F. S., 397.
Becraft, R. J., 27.
Bedevian, Armenag Eff., 826.
Bekker, J. G., 69.
Bělař, K., 800.
Belden, G. O., 30.
Belden, W. S., 313.
Bell, D. S., 257, 457, 458, 472.
Bell, M., 90.
Bemis, E., 200.
Bender, C. B., 561, 765.
Benedict, F. G., 192, 290, 591, 857, 890.
Benedict, S. R., 807.
Bengtson, N. A., 613.
Benner, C. L., 97.
Bennett, H. H., 113, 285.
Bennett, J. P., 243, 816.
Bennett, M. K., 289, 689.
Benoy, M. P., 611.
Benton, A. H., 777.
Benson, B., 388.
Bercaw, L. O., 482.
Berg, H. A., 684.
Berg, V., 897.
Berger, A., 640.
Bergman, H. F., 499, 836.
Bergquist, S. G., 421.
Berlese, A., 858.
Bertolini, F., 357.
Bertoni, A. de W., 800.
Bertrand, G., 888.
Besse, H., 253.
Besse, R. S., 689.
Bessey, E. A., 449.
Bethke, R. M., 456, 463, 667.
Betts, H. S., 775.
Beyma Thoe Kingma, F. H. van, 51.
Bezssonoff, N., 296.
Bezzi, M., 55.
Bichkov, V. A., 757.
Bielert, 536.
Biely, J., 274.
Blester, H. E., 73.
Billmann, E., 809.
Bilek, F., 822.
Bills, C. E., 294.
Bilo, E. F., 287.
Bindra, S. S., 253.
Bing, F. C., 694.
Binney, T. H., 265.
Bioletti, F. T., 336, 337, 528.
Birch, S. F., 379.
Birkeland, J. M., 25.
Bishara, I. Eff., 658.
Bishop, L. R., 818.
Bishopp, F. C., 756, 757.
Bissey, R., 127.
Bissinger, G. H., 828.
Bitler, R. O., 732.
Bjerknes, J., 416.
Black, J. D., 85, 283, 285, 382, 579, 687.
Black, L. M., 867.
Black, W. H., 759, 779.
Blackman, M. W., 359, 661.
Blair, A. W., 714.
Blaizot, L., 571.
Blaizot, P., 571.
Blake, F. G., 269.
Blake, M. A., 290, 733.
Blakeslee, A. F., 24, 214, 215.
Blakeslee, H. H., 397.
Blanchard, E. E., 248.
Blanck, E., 503.
Blaney, H. F., 504.
Blaney, J. E., 558, 599.
Blasingame, R. U., 776, 880.
Bledisloe (Lord), 477.
Bledsoe, R. P., 118, 217, 634, 778.
Bleyer, B., 109.
Blieck, L. de, 699.
Blizzard, W. L., 257.
Blodgett, C. G., 292.
Blodgett, F. M., 241, 346.
Blondeleau, 529.
Bloomfield, E. L., 589.
Boak, R., 673.
Bode, I. T., 531.
Bodenheimer, F. S., 248.
Bodman, G. B., 504.
Bodnar, G. P., 132.
Boerger, A., 825.
Boerner, E. G., 132.
Bohstedt, G., 70, 163, 168, 257, 457.
Boldyreff, A. W., 806.
Bolkay, S. J., 449.
Bomar, W. M., 691.
Bomberger, F. B., 688.
Bondar, G., 755.
Böning, K., 45, 848.
Booth, J. F., 285.
Borden, A. D., 851.
Borg, F., 898.
Borodin, D. N., 827.
Borst, H. L., 130, 487.
Borsenkov, A. K., 757.
Bose, R. D., 222.
Bose, R. E., 235.
Boss, A., 882.
Boswell, V. R., 622, 641.
Botkin, C. W., 728.
Botsford, R. C., 547.
Bourdillon, R. B., 98, 392.

Bourne, A. I., 848.
Bourne, B. A., 657.
Bouyoucos, G. J., 815.
Bowstead, J. E., 259.
Box, H. E., 256, 661.
Boyce, A. M., 246.
Boyce, E. F., 21, 59, 758.
Boyce, J. S., 148.
Boycott, A. E., 469.
Boyd, J. L., 73.
Boyd, M. F., 854.
Boyd, O. C., 654.
Boyden, R., 598.
Boyer, P. B., 200.
Boyle, J. E., 284, 688.
Boynton, W. H., 870.
Boysen, H. H., 266.
Braak, C., 205, 699.
Braatz, C., 280.
Bracken, A. F., 27, 47.
Brackett, E. E., 879.
Brackett, R. N., 615.
Bradford, F. C., 525, 900.
Bradley, C. J., 598.
Brady, F. L., 282.
Brainard, S. W., 897.
Branaman, G. A., 458, 858.
Branch, F. H., 784.
Brandes, E. W., 628.
Brandly, C. A., 70, 73.
Brandon, B. F., 457.
Brandtzaeg, A., 477.
Branegan, G. A., 691.
Branford, R., 567.
Brann, B. F., 712.
Brann, J. W., 147.
Brannen, C. O., 579, 782.
Brase, K. D., 898.
Braun, W., 109.
Bray, C. I., 785.
Bray, G. W., 293.
Breazeale, J. F., 12, 618, 619.
Breed, R. S., 562.
Brennemann, J., 892.
Brenner, 478.
Brenner, W., 688.
Brewbaker, H. E., 122, 216.
Brewer, P. H., 243.
Briand, L. J., 662.
Brierley, W. B., 469.
Brierley, W. G., 85.
Briggs, F. N., 288, 844.
Brigham, G. D., 410.
Brigham, H. C., 478.
Brink, R. A., 630.
Brinley, F. J., 121, 248.
Briton-Jones, H. R., 532.
Brittlebank, C. C., 847.
Britton, N. L., 895.
Britton, W. E., 547.
Brodell, A. P., 782.
Brody, S., 99.
Broerman, A., 274, 478.
Brooke, A., 666.
Brooke, G., 666.
Brooks, A. N., 789.
Brooks, C. E. P., 614.
Brooks, C. F., 814.
Brooks, C. S., 856.
Brooks, F. T., 100.
Brooks, M. M., 120.
Brooks, R. O., 312.
Brooks, S. D., 99.
Broudin, L., 73.
Broughton, L. B., 200, 821.
Brown, A., 391, 404.
Brown, A. P., 891.
Brown, B. A., 430.
Brown, C. A., 103.
Brown, E., 34, 560.
Brown, G. A., 257, 458, 459, 858.
Brown, G. G., 282.
Brown, H. D., 229.
Brown, H. M., 330.
Brown, J. W., 310.
Brown, L., 252.
Brown, P. E., 421, 621, 809.
Brown, P. G., 552.
Brown, R. L., 477.
Brown, R. M., 235, 740.
Brown, S. R., 688.
Brown, W. A., 579.
Brownell, K. A., 491.
Bruce, A. G., 177.
Bruce, D., 285.
Brumpt, E., 269, 567.
Brunett, E. L., 573.
Brunner, E. de S., 687.
Bruno, F., 816.
Brush, W. D., 143.
Brussoff, A., 349.
Bryan, W. E., 639.
Buchanan, A. D., 560.
Buchanan, D S., 397.
Buchanan, J. A., 775.
Buchheim, A., 655.
Buchholz, J. T., 24, 214.
Buechel, F. A., 485.
Buel, J., 404.
Buie, T. S., 31.
Buisman, C. J., 46.
Bull, H., 798.
Bull, S., 460, 691, 768.
Bullis, D. E., 643, 692, 788.
Bunau-Varilla, P., 854.
Bundesen, H. N., 70.
Bunker, C. W. O., 269.
Bunyea, H., 70, 270.
Buonocore, A., 548.
Burch, A., 599.
Burch, J. W., 258.
Burd, F. G., 290.
Burdette, R. C., 655.
Burk, L. B., 257.
Burnet, E., 872.
Burns, A. N., 658.
Burns, R. H., 258.
Burr, W. H., 97.
Burr, W. W., 898.
Burrell, R. C., 823.
Burrier, A. S., 685.
Burtis, M. P., 710.
Buscalioni, L., 818.
Busck, A., 550, 851, 853.
Bushnell, J., 82.
Bushnell, L. D., 70, 73.
Buster, M. W., 85.
Butler, E. J., 45.
Butler, H. G., 253.
Butler, L. F., 244.
Butler, O., 150, 151.
Butler, W. J., 70, 656, 657.
Butterfield, K. L., 285, 579.
Butterworth, J. E., 579.
Button, F. C., 767.
Buxton, R. H., 720.
Buys, C. B., 48.
Bychkov, V. A., 757.

Caesar, L., 663.
Caffrey, D. J., 253.
Cagle, L. R., 855.
Cahill, E. A., 70.
Cain, S. A., 581.
Caläbek, J., 120.
Calder, A., 560.
Call, L. E., 197.
Callenbach, E. W., 868.
Callister, F. E., 599.
Calvert, A. F., 529.
Cameron, D. H., 12, 309.
Cameron, G. C., 872.
Cameron, J., 542.
Cameron, S. H., 886.
Camp, A. F., 837.
Campbell, C. E., 886.
Campbell, J., 381.
Campbell, R. C., 685.
Campbell, R. E., 854.
Campbell, S. G., 802.
Campbell, W. W., 299.
Canan, R. D., 395.
Cance, A. E., 263.
Canning, G. A., 51.
Canon, H., 86.
Cantwell, L. R., 768.
Cappelletti, C., 827.
Capper, A., 285.
Carlson, E. R., 468.
Carlson, J. W., 27.
Carlson, T. A., 278.
Carmer, M. E., 491.
Carne, H. R., 71.
Carne, W. M., 532, 534, 537, 539, 649, 652, 653.
Carpenter, C. M., 471, 673, 674, 872.
Carpenter, E. J., 616.
Carpenter, M. C., 443.
Carpenter, T. M., 195.
Carr, J. M., 136.
Carr, R. B., 99.
Carr, R. H., 625.
Carré, H., 470.
Carrick, C. W., 68.
Carrick, D. B., 426.

Carroll, W. E., 460, 768.
Carter, H. F., 660.
Carter, H. G., 618.
Carter, W., *242*, *249*, *250*.
Carter, W. T., 617.
Cartland, G. F., 193.
Cartwright, O. L., 453.
Carver, J. S., 379.
Carver, T. N., 385.
Carver, W. A., 629.
Cary, A., 443.
Cary, W. E., 673.
Casanova, O. B., 432, 443, 498.
Case, H. C. M., 487, 684.
Casida, L. E., 257.
Castella, F. de, 349.
Castenada, M., 268.
Cathcart, C. S., 21, 211.
Caulfield, W. J., 468.
Cave, H. W., 90, 791.
Césari, 473.
Chadwick, L. C., 398.
Chamberlain, H. D., 820.
Chandler, S. C., 246, 252.
Chandler, W. H., 598.
Chandler, W. L., 469.
Chapman, H. D., 119, 414.
Chapman, H. H., 288.
Chapman, J., 678.
Chapman, O. D., 673.
Chapman, O. W., 204.
Chapman, P. J., 542, 757.
Chappellier, A., 547.
Charles, T. B., 572.
Charles, V. K., 140.
Chatfield, C., 89.
Chavard, A., 232.
Chen, T.-T., *190*.
Chetverikov, N. S., 186.
Cheyney, E. G., 647, 838.
Chick, H., 710, 711.
Child, A. M., 789.
Childs, L., 232, 540, 541.
Childs, R. R., 831.
Chipp, T. F., 100.
Chitre, G. D., 194.
Chittenden, A. K., 442, 645.
Chittenden, F. H., 359.
Chomisury, N., 427.
Chorine, V., 662.
Christensen, C. L., 302, 384.
Christensen, J. J., 100, 588.
Christie, G. I., 894.
Chucka, J. A., 114.
Chung, H. L., 723, 732.
Church, C. B., 891.
Church, L. M., 776.
Churchill, B. R., 46, 432.
Ciuca, A., 268.
Claman, I., 696.
Clapp, E. H., 399.
Clapp, M. H., 712.
Clare, J. L., 894.
Clark, C. F., 723.
Clark, C. W., 792.
Clark, E., 889.
Clark, E. P., 9, 802.
Clark, E. S., 743.
Clark, F. H., 330.
Clark, J. A. (U. S. D. A.), *131*, *216*, *226*, 638.
Clark, J. H., 733, 754, 758.
Clark, L. T., 674.
Clark, M. L., 587.
Clark, M. R., 882.
Clark, N., 197.
Clark, N. A., 23, 413.
Clark, T., 864.
Clarke, A. E., 300.
Clarke, H. T., 609.
Clarke, S. H., 855.
Clarke, W. H., 662.
Clausen, C. P., 557.
Clawson, A. B., 70.
Clawson, R. M., 798.
Claypool, L. L., 900.
Clayton, E. E., 446.
Cleaver, H. M., 690.
Clemente, L. S., 820.
Clements, D. M., 290.
Clements, H. F., 424.
Cline, R. W., 690.
Clinton, C. P., 849.
Closs, J. O., 589.
Clouston, D., 518, 841.
Clow, B., 194, 195.
Clyde, G. D., 75, 774.
Coad, B. R., 360.
Cobb, W. B., 713.
Coblentz, W. W., 50.
Cochel, W. A., 257, 258.
Cockerell, T. D. A., 246.
Code, W. E., 276.
Coe, F. M., 37.
Coffey, W. C., 699.
Coffman, F. A., 25, 223, 728.
Coggin, J. K., 290.
Cogswell, W. F., 656.
Cohn, L., 609.
Coke, J. E., 132.
Colb, C. C., 599.
Colby, A. S., 290, 489, 644.
Cole, F. R., 255.
Cole, H. S. 614.
Cole, J. R., 245.
Cole, L. J., 163.
Cole, R. C., 200.
Coleman, D. A., 33.
Coleman, M. B., 674.
Coleman, T. A., 579.
Coles, E. H., 396.
Collander, R., 120.
Collens, A. E., 332.
Collier, G. W., 78.
Collin, J. E., 357.
Collins, E. R., 418.
Collins, E. V., 682.
Collins, G. N., 426.
Collins, J. L., 226, 499.
Collison, R. C., 338, 398.
Colvin, E. M., 688.
Commons, J. A., 399.
Compere, H., 351, 456, 659.
Condit, I. J., 326, 336.
Conner, A. B. 399.
Conner, S. D., 623.
Connors, C. H., 430, 733, 734.
Conrad, C. M., 803.
Conrad, J. P., 620.
Conrey, G. W., 56.
Consell, E., 872.
Cook, K. M., 579.
Cooke, A. F., jr., 398.
Cooley, J. L., jr., 432, 438, 498.
Cooley, R. A., 656.
Coombs, W., 81.
Coons, G. H., 33, 397, 443, 741.
Cooper, C. F., 847.
Cooper, J. R., 427, 798, 835.
Cooper, M. R., 689.
Copley, T. L., 638.
Corbett, G. H., 753.
Corcuff, C., 875.
Cordes, W. A., 563, 866.
Corlette, C. E., 372.
Cornell, F. D., jr., 79, 683.
Corner, G. W., 632.
Coruthers, J. M., 171.
Cory, E. N., 655.
Costa Lima, A. da, 856.
Coster, C., 817.
Cotner, F. B., 250.
Cotterell, G. S., 248, 450.
Cotton, C. E., 70.
Cotton, E. C., 849.
Cotton, R. T., 458.
Couey, W. G., 729.
Coulter, J. L., 99.
Coventry, F. A., 174.
Cowan, F. T., 151.
Coward, K. H. 90, 390, 69[illegible] 794.
Cowgill, G. R., 193, 895.
Cowgill, H. B., 729.
Cowles, H. C., 741.
Cox, G. J., 90.
Cox, J. F., 432.
Cox, W. M., jr., 294.
Coyne, F. P., 201.
Craig, R. A., 70.
Craig, W. T., 216.
Craigie, J. H., 647, 648.
Crampton, E. W., 559.
Crandall, F. K., 99.
Crane, H. L., 281, 683.
Crane, M. B., 429.
Crance, K. T., 699, 858.
Crawford, A. R., 271.
Crawford, C. H., 169, 466.
Crawford, R. F., 250, 855.
Creech, B. F., 258.
Creech, G. T., 270.
Creelman, G. C., 899.
Cremeans, L. M., 299.

Cremer, W., 502.
Crew, F. A. E., 680.
Crider, F. J., 99.
Crist, J. W., 494, 495, 522.
Critchfield, B. H., 688.
Crocheron, B. H., 394, 895.
Crosby, S. W., 113.
Cross, W. E., 225.
Crowley, D. J., 141.
Cruess, W. V., 387, 412.
Crumb, S. E., 858.
Cruz, M. Manas y, 330.
Cruz, P. I., 331.
Csonka, F. A., 801.
Culbertson, C. C., 258, 759.
Cullinan, F. P., 234, 895.
Culpepper, C. W., 38, 612.
Cunliffe, N., 554.
Cunov, H. F., 199.
Curson, H. H., 69.
Curtis, A. C., 389.
Curtis, H. E., 120.
Curtis, V., 668.
Curtiss, C. F., 394.
Cushman, R. A., 758.
Cutler, J. S., 56.
Cutright, C. R., 140, 252, 450, 456, 546.

Dachnowski-Stokes, A. P., 618.
Dack, G. M., 673.
da Costa Lima, A., 856.
Dade, H. A., 847.
Dague, C. I., 614.
Dague, W. F., 42.
Dahl, F., 55.
Dahlberg, A. C., 565.
Dahlberg, G., 518.
Dailey, A., 599.
Damon, S. C., 825.
Dana, B. F., 536.
Dana, M., 579.
Danforth, C. H., 821.
Danheim, B. L., 543.
Daniel, D. M., 155.
Daniels, A. L., 496, 596.
Dantzig, T., 497.
Darbishire, F. V., 720.
Darrow, G. M., 528.
Das, P. N., 472.
Dash, J. S., 654.
Daubney, R., 874.
Davey, M., 527.
Davidson, G., 579.
Davidson, H. R., 665.
Davidson, J., 549.
Davidson, J. B., 681, 682, 881.
Davidson, W. A., 99.
Davidson, W. M., 248.
Davies, E. S., 891, 892.
Davies, W., 29, 518.
Davies, W. C., 800.
Davis, A. C., 351.
Davis, D. E., 64.
Davis, I. G., 283.
Davis, J. J., 355, 758.
Davis, K. C., 290.
Davis, L. D., 335.
Davis, M. B., 234.
Davis, R. A., 229.
Davis, R. W., 389.
Davis, W. H., 240, 840.
Dawson, R. W., 358.
Day, V. S., 577.
Dean, G. A., 354, 899.
Dearstyne, R. S., 175, 770.
Deatrick, E. P., 321.
Deay, H. O., 395.
de Blieck, L., 699.
de Castella, F., 349.
Deeter, E. B., 15.
de Groot, M., 549.
Deighton, T., 260.
de Jong, J. K., 549.
de Kock, G., 69.
Delafield, J., 404.
Delez, A. L., 468.
Delf, E. M., 515.
DeLong, D. M., 548.
DeLong, G. E., 226.
Delwiche, E. J., 128, 331.
Demaree, J. B., 245.
Demerec, M., 215.
Deming, G. W., 520.
Demolon, A., 206.
Dencker, C. H., 478.
Denman, C. B., 302.
Dennett, R. H., 593.
de Peralta, F., 719.
Depew, H. F., 171, 767.
de Rippas, P., 253.
DeRose, H. R., 20.
Descazeaux, J., 374.
DeTurk, E. E., 17, 809.
Deuber, C. G., 324.
DeVault, S. H., 583.
Devereux, E. D., 467, 867.
Devereux, R. E., 16, 112.
de Villiers, F., 756.
Dewey, L. H., 729.
DeYoung, W., 422.
Deysher, E. F., 565.
D'íàkonov, A. P., 826.
Diakov, F. A., 710.
Dibble, C. B., 454, 851.
Dickens, A., 896.
Dickey, J. A., 580.
Dickins, D., 291.
Dickinson, L. S., 828.
Dickson, G. H., 281.
Dickson, J. G., 148, 149, 327.
Dickson, R. E., 574.
Diebl, H. C., 40.
Diehm, R. A., 620.
Dieren, J. W. van, 285.
Diettert, R., 443.
Digby, M., 887.
Dillewijn, C. van, 817.
Dilley, J. R., 78.
Dimock, W. W., 73, 373.
Dingler, M., 758.
Dinwiddie, R. R., 798.
Dixon, M., 807.
Doan, F. J., 868.
Dobrovolny, C. G., 896.
Dobson, G. M. B., 313.
Dodd, D. R., 518.
Dodge, B. O., 348.
Dodge, C. W., 513.
Doidge, E. M., 658.
Donatien, A., 175.
Doornkaat Koolman, H. ten, 843.
Doran, W. L., 839.
Dorcas, M. J., 513.
Dore, W. H., 524.
Dorman, C., 321.
Dorman, H. P., 573.
Dorofeev, A. F., 71.
Dorsett, J. H., 41.
Dorsett, P. H., 41.
Dorsey, H., 637.
Dorsey, M. J., 283.
Doucette, C. F., 547.
Douglas, D., 200.
Douglas, S. R., 469.
Dowling, R. N., 346, 884.
Down, E. E., 330.
Dowson, H. V. W., 529.
Doyle, L. P., 861.
Dozier, H. L., 248, 253, 798.
Dozois, K. P., 398.
Drain, B. D., 833.
Drechsler, C., 236, 746.
Drewitt, H., 884.
Driftmier, R. H., 395, 681.
Driggers, B. F., 451, 552, 662, 750.
Drinkard, A. W., jr., 797.
Drummond, J. C., 709, 894.
Dubois, C. N., 638.
Ducceschi, V., 586.
Dufrenoy, J., 822.
Duggar, B. M., 540.
Duley, F. L., 519.
Duncan, C. S., 287.
Dunegan, J. C., 845.
Dungan, G. H., 837.
Dunlap, G. L., 677.
Dunlap, R. W., 258.
Dunlavy, H., 826.
Dunn, L. C., 821.
Dunn, M. H., 858.
Dunn, S., 139, 149.
Dunshee, C. F., 378.
Duran, V., 854.
Durand, H., 530.
Dureuil, E., 695.
Durham, G. B., 429.
Durrell, L. W., 136.
Durst, C. E., 429.
Duruz, W. P., 395.
Dutcher, R. A., 667.

du Toit, P. J., 69.
Dutt, N. L., 29.
Duvel, J. W. T., 688.
Dvorachek, H. E., 257.
Dyar, H. G., 55, 550.
Dye, M., 494, 495, 599.
Dyke, R. A., 614.

Eagles, B. A., 90.
East, E. M., 215, 428, 721.
Eaton, A., 404.
Eaton, F. M., 30.
Eaton, N. A., 655.
Eaton, O. N., 218.
Eberle, A. M., 599.
Eddy, C. O., 452, 546, 662.
Eddy, W. H., 94.
Edgar, R., 95, 897.
Edgington, B. H., 274, 456, 473.
Edmond, J. B., 87, 200.
Edwards, A. A., 598.
Edwards, F. R., 161.
Edwards, J. T., 673.
Edwards, P. R., 273.
Edwards, W. E. J., 257, 462.
Edwards, W. L., 78.
Efimov, A., 472.
Eftimiu, P., 818.
Eibl, A., 887.
Eldinow, A., 568.
Eisenmenger, W. S., 818.
Ejercito, J. M., 831.
Eke, P. A., 198, 600, 888.
Eklund, E. E., 313.
Elazari, M., 225.
Elden, C. A., 893.
Elden, H. van, 326.
Elder, C., 878.
Eliot, C. P., 660.
Elledge, L. C., 268.
Ellenberger, H. B., 257.
Ellenwood, C. W., 439, 527, 836.
Ellett, W. B., 624, 718, 717, 735, 736.
Elliott, C., 48.
Elliott, F. F., 181, 782.
Ellis, E., 599.
Ellison, E. S., 111.
Elmslie, W. P., 195.
Elsawy, A. H., 836.
Elvehjem, C. A., 612.
Elver, V., 898.
Elwell, J. A., 111, 899.
Ely, R. T., 285.
Else, D. L., 651.
Embleton, H., 560.
Emerson, R. A., 722.
Emmel, M. W., 200, 875.
Emsweller, S. L., 427.
Engelmann, F., 51.
Engle, E. T., 827.
Englund, E., 699.
Enslow, H. R., 284.
Erdman, L. W., 520.
Erikson, S. E., 199.
Erlanson, E. W., 217.
Essig, E. O., 852, 848.
Estor, W., 213.
Ettisch, G., 412.
Euler, H. von, 793.
Evans, A. C., 674.
Evans, H. M., 92, 297.
Evans, M. W., 637.
Evans, W. A., 70, 271.
Evaul, E. E., 521.
Evers, N., 388.
Evvard, J. M., 258, 759, 860.
Ewig, W., 412.
Ewing, H. E., 456.
Eyer, J. R., 355.
Eyster, W. H., 215.
Ezekiel, M., 578.
Ezekiel, W. N., 348.

Fabian, F. W., 468.
Fabre, R., 195, 596, 896.
Fabry, R. J. C., 18.
Faes, H., 348.
Fagan, T. W., 30, 32.
Fahmy, T., 345.
Fall, H., 830.
Falck, R., 542.
Falconer, J. I., 181, 482, 579, 684, 888.
Fargo, J. M., 163, 257.
Farley, A. J., 733.
Farley, H. B., 642.
Farr, A. G., 192, 890.
Farr, C. H., 626.
Farr, W. K., 816.
Farrall, A. W., 282, 375, 376, 467, 779.
Farrell, F. D., 285.
Farwell, G. M., 199.
Faurot, D., 141.
Faurot, F. W., 797.
Fawcett, H. S., 245, 395, 747.
Fehér, D., 349.
Fellers, C. R., 889.
Fellows, H. C., 83.
Felt, E. P., 546, 548.
Fenton, F. C., 395, 881.
Ferguson, C. M., 469.
Ferguson, I. W., 598.
Fernald, H. T., 848.
Fernandes, D., 43.
Fernandez, 814.
Ferraris, T., 532.
Ferrin, E. F., 60.
Ferris, G. F., 546.
Fetrow, W. W., 484.
Feytaud, J., 547, 658.
Ficke, C. H., 445.
Fielding, W. L., 808.
Filinger, G. A., 450.
Findlay, G. M., 495.
Finn, W. G., 782.
Finnell, H. H., 32, 77, 131, 432, 447, 532, 825.
Fischer, A. J., 480.
Fischer, F., 803.
Fischer, H., 426.
Fischmann, C., 392.
Fish, P. A., 570.
Fish, S., 345, 347, 348.
Fisher, D. F., 40.
Fisher, E. A., 586.
Fisher, H. J., 855.
Fisher, M. S., 897.
Fisher, R. C., 855.
Fisher, R. T., 283.
Fisher, W. S., 255.
Fiske, G. B., 187.
Fiske, J. G., 437.
Fitch, J. C., 888.
Fite, A. B., 37, 141, 738.
Fitts, H. F., 688.
Flanders, S. E., 256.
Fleischman, C. L., 404.
Fleming, A., 469.
Fleming, W. E., 510, 546.
Fletcher, E. H., 614.
Flint, L. H., 426, 440.
Flint, W. P., 252, 254, 357, 547.
Flintoff, A., 541.
Flor, H. H., 397.
Flora, S. D., 613.
Florell, V. H., 328.
Fluharty, L. W., 288.
Fluke, C. L., 154.
Flury, F., 297.
Flynt, J. J., 97.
Foex, 547.
Fogle, F. E., 779.
Follett, D. W., 795.
Folsom, D., 540.
Folsom, J. C., 285, 786.
Forbes, E. B., 791.
Ford, O. W., 441.
Ford, W. W., 660.
Forsling, C. L., 558.
Forster, G. W., 686.
Forsyth, W. H., 289.
Foster, H. D., 281.
Foster, W. A., 179.
Fourie, P. J. J., 69.
Fourt, D. L., 766.
Foust, R., 591.
Fouts, E. L., 564.
Fowler, E. D., 616.
Fox, F. E., 79.
Fox, H., 247.
Frame, N. T., 579.
Francis, L., 599.
Frankenfield, H. C., 400.
Franklin, H. J., 832, 6 849.

Fraser, J. G. C., 830.
Fraser, W. P., 289.
Fred, E. B., 107, 115, 127, 712.
Frederick, H. J., 69.
Freeman, W. G., 528.
Friedemann, T. E., 806.
Friedemann, W. G., 598.
Friedmann, H., 848.
Friend, R. B., 555.
Friesner, R. C., 531.
Frisch, R., 81.
Fromme, F. D., 745.
Fronda, F. M., 862.
Frost, S. W., 252.
Frye, W. W., 373.
Fudge, B. R., 739, 747.
Fullaway, D. T., 753.
Fuller, F. D., 158.
Fuller, J. E., 810.
Fuller, J. G., 160, 161, 163.
Fulton, B. B., 853.
Fulton, H. R., 50.
Furry, M., 95.
Futamura, H., 372, 570, 675, 870.

Gabbard, L. P., 581.
Gabriel, H., 284.
Gaddum, J. H., 889.
Gaines, E. F., 223.
Gaines, J. C., jr., 556.
Gaines, J. G., 554.
Gaines, R. C., 360.
Gainey, P. L., 620.
Galang, F. G., 330.
Gallagher, H. J., 881.
Galloway, I. A., 568.
Galloway, Z. L., 782.
Gallup, W. D., 613, 765.
Galpin, C. J., 579.
Gammon, C., 255.
Ganga Ram, M., 399.
Garber, R. J., 136, 429, 517, 518, 520.
Garcia, F., 298, 738.
García López, A., 50.
Gardner, F. E., 230, 231, 336.
Gardner, J. C. M., 850.
Gardner, M. E., 725, 735.
Gardner, M. W., 243.
Gardner, V. R., 40, 290, 442, 498, 797, 900.
Gardner, W., 477.
Garlock, F. L., 199.
Garman, H., 199.
Garman, P., 359, 547.
Garner, E. S., 825, 900.
Garnett, W. E., 788.
Garris, E. W., 290.
Garrison, W. H., 290.
Garver, H. L., 379.
Garver, R. D., 144.
Gassner, G., 300, 534, 626, 837.
Gaston, H. P., 187.
Gaston, T. L., jr., 581.
Gater, B. A. R., 753.
Gault, L., 120.
Gäumann, E. A., 518.
Gaumont, L., 547.
Gaylord, F. C., 690.
Gebhardt, H., 171.
Geddings, E. N., 546.
Gee, A. R., 336.
Gelb, H. V., 616.
Gelb, W. J., 315, 616.
Geismer, L. M., 307.
Genaux, C. M., 600.
Gentner, L. G., 358.
Genung, A. B., 284.
Georgeson, C. C., 158.
Gerdeman, A. E., 566.
Gerlaugh, P., 457, 665, 858.
Germain, L., 171.
Germuth, F. G., 109.
Gerstenberger, H. J., 896.
Ghawabi, A. A., Eff. el, 657.
Gherzi, E., 313.
Ghosh, B. N., 502.
Gibbons, C. E., 157.
Gibbs, O. S., 374.
Gibson, A., 450.
Gibson, E. E., 393.
Gibson, F., 99.
Giddings, N. J., 399.
Giese, H., 679.
Gifford, W., 169.
Gilbert, A. H., 48.
Gilbert, B. E., 13, 533, 690.
Gilbert, C. H., 663.
Gilbert, R., 674.
Gilbert, W. W., 746.
Gildow, E. M., 166, 175, 176.
Gile, B. M., 382, 785.
Giles, J. K., 685.
Gilkey, H. M., 227.
Gill, G. A., 59.
Gillett, C. A., 798.
Gillette, C. P., 151, 197.
Gillies, D. R., 70.
Gillis, M. C., 25.
Gilman, A., 557.
Gilmer, P. M., 354.
Giltner, W., 70, 674, 873.
Ginsburg, J. M., 451, 452, 544, 751.
Giordano, A. S., 268.
Girard, H., 859.
Gladkii, M. F., 220.
Gladwin, F. E., 141.
Glasgow, H., 543, 554.
Gleisberg, W., 834.
Glessing, B. F., 821.
Glover, A. J., 70.
Goar, L. G., 328.
Godwin, H., 818.
Goebel, F., 896.
Goessmann, C. A., 701.
Goffart, H., 542.
Goke, A. W., 617.
Goldberger, J., 496, 597.
Golding, F. D., 450.
Golding, J., 264.
Goldthwaite, N. E., 291.
Goloviznin, D. D., 854.
Goloviznin, D. D., 854.
Gooderham, C. B., 455.
Goodsell, S. F., 221, 331.
Goodwin, M. W., 20, 322, 499.
Goodwin, W., 545, 648.
Gordon, M., 820.
Gorjatschkin, W., 680.
Goss, R. W., 651.
Goss, W. L., 34.
Gossip, F. J., 258.
Gouaux, C. B., 636.
Gould, G. E., 757.
Gourley, J. H., 439.
Graber, L. F., 128, 220.
Grace, N. S., 300.
Graebner, P., 532.
Graham, J. J. T., 544.
Graham, R., 70, 677, 772, 871.
Graham, S. A., 355, 580, 756.
Gramlich, H. J., 160.
Grandfield, C. O., 396.
Granovsky, A. A., 154.
Grantham, G. M., 830.
Grasovsky, A., 42.
Grassé, P. P., 658.
Graves, R. R., 669.
Gray, D. S., 16.
Gray, G., 882.
Gray, G. F., 499.
Gray, L. C., 283, 284.
Greaves, J. E., 19, 409.
Green, G. A., 800.
Green, R. G., 872.
Green, R. M., 186, 396.
Green, T. C., 417.
Greene, C. T., 357.
Greene, D., 392.
Gregg, W. R., 111.
Gregory, C. T., 355.
Gress, E. M., 334.
Greve, F. W., 378.
Grewe, E., 386, 807.
Grey, E. C., 88.
Grier, W. D., 96.
Grierson, A. M. M., 470.
Griesbeck, 300.
Griffing, E. P., 658.
Griffith, C. H., 154.
Griffith, F. R., jr., 491.
Griffith, H. D., 92.
Griffith, M., 897.
Griffiths, F. J., 889.
Grijns, A., 514.

Grimes, M. F., 398.
Grimes, W. E., 182, 285.
Griswold, G. H., 155.
Grüner, S. A., 472.
Groesbeck, W. M., 674.
Groissmayr, F., 313.
Groot, M. de, 549.
Grossfeld, J., 609.
Grossman, E. F., 556, 856.
Groth, A. H., 392.
Grundmeier, E. G., 192.
Guba, E. F., 448, 839, 840.
Guberlet, J. E., 573.
Guerrant, N. B., 12, 91.
Gui, H. L., 450, 554.
Guilliermond, A., 819.
Gulati, A. N., 635.
Gunn, D., 550.
Gunness, C. I., 110, 314, 713.
Gunns, C. A., 396.
Gurskii, A. V., 235.
Gursky, A. V., 235.
Guthrie, E. S., 868.
Guyton, T. L., 552, 546, 662.
Gwynne-Vaughan, H. C. I., 513.
Gye, W. E., 469.

Haas, A. R. C., 529, 837.
Haber, E. S., 339, 494, 495, 642.
Hackett, L. W., 854.
Haddon, C. B., 98.
Haenseler, C. M., 743.
Hafenrichter, A. L., 500.
Hagan, W. A., 569, 675.
Hägglund, E., 202.
Haglund, E., 369.
Haigh, L. D., 815.
Haile, H., 859.
Haines, G., 257, 699.
Hale, L. M., 199.
Haley, W. E., 254, 663.
Hall, C. J. J. van, 699.
Hall, F. H., 640, 900.
Hall, G. M., 773.
Hall, G. O., 669.
Hall, M. C., 70.
Hall, T. D., 287.
Hall, W. T., 711.
Hallman, E. T., 468, 471.
Hallock, H. C., 358, 556.
Halma, F. F., 529, 837.
Halpin, J. G., 164, 165.
Halton, P., 586.
Halverson, J. O., 762.
Hamilton, C. C., 255, 544.
Hamilton, H. G., 782.
Hamilton, J. M., 148.
Hamilton, T. R., 600.
Hamilton, T. S., 9, 461.
Hammer, B. W., 563.
Hammond, A. A., 348.
Hammond, J., 821.
Hammond, W. E., 759.
Hampil, B., 804.
Hanan, E. B., 682.
Hance, R. T., 819.
Hand, I. F., 818.
Hankins, O. G., 462.
Hannay, A. M., 100.
Hansen, D., 733, 797.
Hansen, H. N., 659.
Hansen, M. C., 381.
Hansen, N. E., 480, 517.
Hansen, P., 174.
Hansen, T. S., 235.
Hanson, H. C., 512.
Hanzlik, E. J., 41.
Hanzlik, P. J., 393.
Hardy, A. V., 674.
Hardy, F., 203.
Hardy, M. C., 388.
Harington, C. R., 201, 202.
Harlan, H. V., 220.
Harlan, J. D., 338, 398.
Harlow, W. M., 815.
Harman, S. W., 155.
Harmon, P. H., 673.
Harper, C., 259.
Harrington, J. B., 638.
Harris, A. W., 2, 701.
Harris, G. H., 524.
Harris, J. A., 31, 437, 817.
Harris, L. J., 297.
Harris, R. V., 846.
Harrison, G. J., 437.
Harrison, T. J., 220.
Harrison, W. H., 29.
Harrold, E., 198.
Hart, E. B., 70, 164, 165, 168.
Hart, R., 544.
Hart, W. J., 383.
Hart, W. R., 899.
Harter, L. L., 447.
Hartman, G., 437.
Hartman, H., 40, 541, 648, 779.
Hartman, J. I., 896.
Hartman, W. A., 381.
Hartwell, G., 894.
Hartzell, A., 545.
Hartzell, F. Z., 246, 253.
Harvey, R. B., 24, 38, 517.
Hashiguchi, W., 870.
Haskins, H. D., 20, 822.
Hasseltine, H. E., 660.
Hastings, A. B., 805.
Hastings, E. G., 178, 899.
Hastings, R. C., 99.
Haswell, W. A., 847.
Haterius, H. O., 631.
Hatfield, I., 782.
Hatton, R. G., 348.
Hauck, C. W., 181, 482, 684
Hauduroy, P., 819.
Hauge, S. M., 68.
Haupt, H., 856.
Hausman, L. A., 655.
Haward, H. E., 575.
Hawker, H. W., 112.
Hawley, E., 191.
Hawthorn, L. R., 640.
Hawthorne, H. W., 686.
Hayden, C. C., 465, 466.
Hayes, F. A., 16, 617.
Hayes, H. K., 122, 216, 327, 338.
Haynes, D., 310.
Hays, F. A., 326.
Hays, I. M., 91.
Headlee, T. J., 251, 452, 655, 749, 849.
Headley, F. B., 561.
Healy, D. J., 199, 378.
Heck, A. F., 115, 119.
Hectorne, R. L., 677.
Hedenburg, O. F., 100.
Hedges, H., 182.
Hedrick, U. P., 640.
Hegner, R., 274.
Heinbecker, P., 87.
Heinrich, C., 357.
Heinricher, E., 654.
Heintzleman, B. F., 42.
Heisley, M. F., 385.
Heitshu, D. C., 680, 772.
Heitz, T. W. 787.
Helfgat, J. I., 204.
Hellström, H., 793.
Helm, C. A., 883.
Helm, R., 470.
Helmrich, F. H., 257.
Hemmi, T., 21, 647, 654.
Hendel, F., 55.
Henderson, C. F., 352.
Henderson, C. N., 780.
Henderson, G. S., 479, 882
Henderson, H. O., 67.
Hendrickson, A. H., 378.
Hendrickson, B. H., 16.
Hendrickson, C. I., 288.
Hening, J. C., 565.
Henke, L. A., 262, 666.
Henning, G. F., 578.
Henriques, C. Q., 381.
Henry, A. J., 110, 111, 313, 314, 613, 614.
Henry, B. S., 567.
Henry, D. H., 815.
Henry, M., 870.
Hepler, J. R., 139.
Heppner, M. J., 234, 235.
Herbert, F. B., 252.
Hering, M., 55.
Herms, W. B., 246, 251.
Herr, E. A., 454.
Herrick, G. W., 155, 250.
Hervey, G. E. R., 155, 398.
Hervey, J. G., 285.
Hesler, L. B., 853.
Hess, A. F., 295, 596.
Hess, B. P., 881.
Hessler, M. C., 87.
Heudebert, 695.
Heukelekian, H., 480, 780.
Heuser, C. H., 632.

Heyl, H. H., 579.
Heywang, B. W., 572.
Heywood, H. B., 548.
Hibbard, B. H., 285, 881.
Hibbard, R. P., 423.
Hickey, S. G. M., 267.
Higashi, T., 870.
Higby, W. M., 107.
Higgins, J. E., 529.
Hilger, A., 472.
Hill, C. S., 478.
Hill, E. B., 482.
Hill, F. F., 397.
Hill, H., 234.
Hill, H. H., 624, 713, 717, 735.
Hill, J. B., 217.
Hill, R., 63, 862.
Hills, J. L., 96.
Hilton, G., 174.
Hilton, H. C., 142.
Hindle, E., 469.
Hinds, W. E., 256.
Hinrichs, H. S., 880, 881.
Hinshaw, W. R., 70, 677.
Hirsch, P., 807.
Hirst, C. T., 409.
Hitchcock, J. A., 83, 84, 85.
Hixon, R. M., 516.
Hoagland, D. R., 320.
Hoagland, R., 890.
Hobson, A., 895.
Hochbaum, H. W., 87, 258.
Hodges, J. A., 182, 396.
Hodgson, B. E., 56.
Hodgson, P., 191.
Hodgson, R. E., 381.
Hodgson, R. W., 336.
Hoeden, J. van der, 471.
Hoefer, C., 388.
Hoefle, O. M., 441.
Hoffer, C. R., 585.
Hoffman, A. H., 876.
Hoffman, A. M., 872.
Hoffman, G. W., 285.
Hoffman, I. C., 440.
Hoffmann, W. E., 753, 754.
Hofmann, E., 824.
Hofmann, F. W., 735.
Hogan, A. G., 257.
Hogentogler, C. A., 477.
Hoggan, I. A., 149, 549.
Holbert, J. R., 327.
Holdsworth, R. P., 798.
Hollingshead, R. L., 326.
Hollingworth, W. G., 70.
Holloway, T. E., 254, 256, 663.
Hollowell, E. A., 649.
Holm, G. E., 291, 586, 565.
Holman, R. M., 512.
Holmes, A. D., 294, 795.
Holmes, C. E., 165.
Holmes, C. L., 181, 678.
Honeywell, E. M., 294.
Hood, C. E., 356.
Hood, G. W., 227.
Hooker, H. D., 899.
Hooker, J. R., 638.
Hooker, W. A., 699.
Hooper, C. H., 526.
Hootman, H. D., 40, 230.
Hoover, H., 104.
Hoover, (Mrs.) H., 104, 105.
Hoover, M. M., 217, 429.
Hopkins, E. F., 334.
Hopkins, E. S., 881.
Hopkins, J. A., jr., 884, 886.
Hopkins, J. V., 67.
Hopkins, M., 199.
Horn, W., 858.
Horne, S. J., 70.
Horne, W. T., 245.
Horner, J. T., 288.
Horsfall, W. R., 856.
Höstermann, 841.
Höstermann, G., 532.
Hostetler, E. H., 762.
Hou, H. C., 864.
Hough, W. S., 155, 355.
House, E. B., 177.
House, M. C., 494, 495, 893.
Houser, J. S., 252, 258, 450.
Howard, C. H., 763.
Howard, C. S., 773.
Howard, N. O., 542.
Howard, W. L., 234, 335, 598.
Howe, H., 482.
Howe, P. E., 257.
Howell, A. H., 655.
Howes, D. A., 379.
Howlett, F. S., 439.
Hoyle, J. C., 896.
Huber, L. L., 56, 253.
Huberty, M. R., 378.
Huckett, H. C., 154, 554, 662.
Huddleson, I. F., 471, 673, 674.
Hudson, C. B., 676.
Hudson, G. V., 755.
Hudson, R. S., 34.
Hudson, S., 756.
Hudson, W. R., 847.
Huelsen, W. A., 25.
Huffman, C. F., 262, 469, 498.
Hughes, E. S., 598.
Hughes, H. D., 220.
Hughes, J. S., 491, 565, 791.
Hughes, T. P., 770.
Huldschinsky, K., 94.
Hull, F. E., 278, 878.
Hull, H. H., 119.
Hultz, F. S., 258.
Hume, H. H., 522.
Humphrey, G. C., 168.
Humphrey, H. B., 445.
Humphreys, W. J., 204.
Humphries, W. R., 78, 776.
Hungerford, C. W., 538, 898.
Hungerford, H. B., 364.
Hunscher, H., 292.
Hunt, C. H., 456.
Hunt, G. M., 679.
Hunt, O. D., 881.
Hunt, R. E., 759.
Hunter, J. E., 898.
Hunter, M. H., 579.
Hunwicke, R. F., 694.
Hunziker, O. F., 563, 866.
Hurd, E. B., 483.
Hurd, W. E., 813, 818.
Hurt, R. H., 347.
Hutcheson, T. B., 638, 716, 726, 730.
Hutchins, A. E., 722, 834.
Hutchins, L. M., 11.
Hutchins, W. A., 765.
Hutchinson, C. R., 579.
Hutson, J. B., 581, 782.
Hutson, R., 752.
Hutton, M. K., 496.
Hutton, S. B., 751.
Hyde, A. M., 688.
Hyde, D. F., 617.
Hyde, W. C., 800.
Hyman, M., 805.
Hyslop, G. R., 227, 633.

Iizuka, A., 870.
Ikeler, K. C., 59.
Iljin, W. S., 212, 518.
Illingworth, J. F., 850, 856.
Immer, F. R., 333.
Inamdar, R. S., 816.
Ingalls, R. A., 397.
Ingberg, S. H., 281.
Ingold, C. T., 212.
Insko, W. M., jr., 163, 169, 257.
Irish, J. H., 387.
Irvin, C. J., 436.
Irvin, R. R., 100.
Irvine, B. F., 599.
Irvine, J. C., 291.
Irwin, D. A., 872.
Irwin, M., 513.
Isaac, P. V., 657.
Isaacson, M. R., 798.
Isely, D., 58.
Israelsen, O. W., 477.
Itagaki, S., 571, 678.
Ito, S., 569.
Ivanow, S., 625.
Iverson, G. W., 681.
Iverson, J. P., 70.
Ivins, L. S., 385.

Jackson, A. D., 298.
Jackson, F. H., 78.
Jackson, H. H. T., 548.
Jackson, L. E., 209.
Jackson, R. E., 70.
Jackson, R. W., 89.
Jacob, H. E., 237, 645, 78[illegible]

Jacob, J. C. s', 515.
Jacobs, E., 200.
Jacobs, H. L., 837.
Jacocks, W. P., 660.
Jacotot, H., 871.
James, E. W., 379.
James, H. C., 850.
James, N., 672.
Jannin, G., 859.
Janssen, G., 319, 330, 334, 339, 536, 830.
Japing, C., 43.
Jardine, J. T., 96.
Jardine, W. M., 285, 498, 579.
Jarra, I. E., 673.
Jarussowa, N., 296.
Jarvis, E., 658.
Jary, S. G., 356, 848.
Jefferson, L. P., 690.
Jendrassik, A., 297.
Jenkins, J. H., 278.
Jenkins, R. G. C., 392.
Jennings, D. S., 11, 18.
Jennings, W. W., 489.
Jenny, H., 316.
Jensen, H. J., 900.
Jensen, H. L., 507.
Jepson, F. P., 882.
Jochems, S. C. J., 332, 549.
Jodidi, S. L., 22.
Joessel, 547.
Joffe, J. S., 503.
Johnson, A. H., 200.
Johnson, A. N., 78.
Johnson, E. C., 598.
Johnson, J., 149, 150, 537.
Johnson, J. P., 547.
Johnson, M., 678.
Johnson, M. B., 257.
Johnson, O. M., 578.
Johnson, O. N., 165.
Johnson, O. R., 883.
Johnson, S. E., 483, 684.
Johnson, T., 237.
Johnson, T. D., 885.
Johnson, T. L., 568, 569.
Johnson, W. T., 74.
Johnston, C. O., 46.
Johnston, E. S., 320, 524.
Johnston, H. B., 657.
Johnston, P., 199.
Johnston, P. E., 487.
Johnston, S., 41, 230, 234, 290, 498.
Jones, C. P., 804.
Jones, C. R., 557.
Jones, D. B., 801.
Jones, D. L., 521.
Jones, D. W., 57.
Jones, E., 518, 624.
Jones, F. R., 885.
Jones, H. A., 528.
Jones, H. R. B.-, 532.
Jones, J. M., 387, 388.
Jones, J. P., 132, 332, 828, 832.
Jones, J. S., 210, 692.
Jones, J. W., 225, 378.
Jones, L. H., 832.
Jones, L. O., 110, 314, 713.
Jones, L. R., 147.
Jones, M. F., 455.
Jones, P. M., 242.
Jones, R. L., 90, 495.
Jones, R. M., 250.
Jones, S. C., 624.
Jones, W. A., 518.
Jong, J. K. de, 549.
Jordan, D., 596.
Jordan, H. V., 14.
Jordan, P. S., 258.
Joseph, A. F., 505, 506.
Josephson, H. B., 681, 776, 880.
Joslin, E. P., 796.
Joslyn, M. A., 287.
Jull, M. A., 64, 669, 864.

Kable, G. W., 79.
Kahlenberg, L., 589.
Kakavas, J. C., 499.
Kakizaki, C., 372, 568.
Kalcheva, D., 88.
Kalitin, N. N., 313.
Kampmeier, O. F., 631.
Kannan, K. K.-, 455.
Kantor, H. S., 486.
Kapshull, F., 109.
Karataev, I. A.-, 503.
Karl, O., 55.
Karper, R. E., 518, 521.
Kasai, H., 372, 571.
Kasai, K., 569.
Kato, K., 572, 821.
Kauffman, L. A., 258.
Kaupp, B. F., 175, 764, 770.
Kawakami, K., 794.
Kawamura, Y., 372, 870.
Kearney, C. A., 268.
Kearney, T. H., 221.
Keet, J. D. M., 531.
Keitt, G. W., 148.
Kelleher, R. C., 179.
Kellermann, W. F., 775.
Kelly, E. G., 354.
Kelly, O. W., 334.
Kelser, R. A., 675.
Kelsheimer, E. G., 56.
Keményffi, A. G., 297.
Kemp, W. B., 122.
Kendall, A. I., 806.
Kendall, E. W., 282.
Kendall, J. C., 197.
Kendall, J. L., 614.
Kennard, D. C., 79, 179, 456, 463, 667, 863.
Kennaway, E. L., 297.
Kennedy, C., 597.
Kennedy, P. B., 224, 227, 327.
Kenoyer, L. A., 531.
Kerlee, R., 656.
Kernkamp, H. C. H., 675.
Kerns, K., 499.
Kerr, H. W., 22.
Kerr, J. A., 14, 616, 617.
Kerr, W. H., 114.
Kertesz, Z. I., 898.
Kessell, S. L., 531.
Kezer, A., 115, 520.
Kharbush, S., 818.
Kick, C. H., 456.
Kidd, F., 528.
Kiesselbach, T. A., 129, 327, 518.
Kifer, R. S., 182.
Kii, N., 372.
Kik, M. C., 697, 792.
Killough, D. T., 826.
Kimball, H. H., 111, 313, 314, 614.
Kimbrough, W. D., 224.
Kimm, R., 794.
Kimura, K., 800.
Kincaid, R. R., 198.
Kincer, J. B., 313.
King, C. J., 745.
King, C. L., 284, 285.
King, F. G., 664.
King, H. H., 657, 658.
King, J. R., 285.
King, L., 297.
King, M. J., 272, 570, 674, 872.
King, W. I., 597.
Kingma, F. H. van B. T., 51.
Kingsley, F. C., 878.
Kinkead, G. W., 354.
Kirk, L. E., 635.
Kirkpatrick, E. L., 188, 579.
Kirkpatrick, W. F., 475.
Kirkwood, J. E., 42.
Kirssanoff, A. T., 827.
Kittredge, J., 645.
Klages, K. H., 330.
Klebahn, H., 800.
Kleberg, R., 70.
Klein, I. J., 891.
Klein, J. D., 491.
Klemmedson, G. S., 686.
Kligler, I. J., 274.
Klit, A., 309.
Klotz, L. J., 287.
Klugh, A. B., 300.
Knandel, H. C., 667.
Knight, H. G., 799.
Knight, H. L., 699.
Knight, J. B., 400.
Knobel, E. W., 112.
Knop, J., 501, 502.

Knott, J. E., 397.
Knowlton, G. F., 54, 851.
Knowlton, H. E., 288.
Knox, C. W., 464.
Knox, J. H., 559.
Knudsen, H. R., 812.
Knudson, A., 495.
Knudson, L., 819.
Koch, F. C., 23, 193, 790.
Koch, M., 720.
Kock, G. de, 69.
Koernicke, M., 427.
Kogert, H., 808.
Köhler, E., 300, 532, 537.
Kohls, C. L., 297.
Kojima, H., 626.
Kôketsu, R., 627.
Kolb, J. H., 188.
Kommerell, E., 515.
Kondô, M., 520, 895.
Kondo, S., 372.
Koolman, H. ten D., 843.
Kosmanoff, S. I., 527.
Kotila, J. E., 33, 443.
Kotowski, F., 515.
Kovrigin, A. A., 472.
Kozlovsky, S., 268.
Koz'manov, S. I., 527.
Kramer, I. M., 72.
Kramer, J., 768.
Kramer, M. M., 468.
Krantz, F. A., 722.
Kratz, A. P., 577.
Krause, H. H., 309.
Krauss, F. G., 499.
Krauss, W. E., 169, 170, 465, 466, 490.
Kraybill, H. R., 243, 732.
Kreiter, E. A., 354.
Kreuter, E. A., 354.
Kreyenberg, J., 753.
Kribs, D. A., 43.
Krische, P., 610.
Krishnamurthi Rao, K., 332, 636.
Krout, W. S., 398.
Krueger, J., 200.
Krueger, T., 142.
Kruse, H. D., 390.
Krusekopf, H. H., 810, 883.
Krynine, D. P., 878.
Kubelkova, O., 502.
Kubina, H., 312.
Kučera, C., 295.
Kuckuck, H., 300.
Kuhlman, A. H., 168.
Kuhn, P., 720.
Kuhni Kannan, K., 455.
Kuijper, J., 549.
Kunkel, L. O., 741.
Kutty, M. P. K., 558.
Kyle, C. H., 745.

Laake, E. W., 757.
Lackey, J. B., 55.
Lacy, I. O., 780.
Lagassé, F. S., 835.
Lagrange, E., 572.
Lahaye, J., 876.
Laible, R. J., 460.
LaMaster, J. P., 66, 67.
Lambert, W. V., 257, 668.
Lamiman, J. F., 851.
Lamson, P. D., 678.
Landis, B. Y., 579.
Landreth, C., 500.
Landsbury, J., 711.
Lane, C. B., 400.
Lang, W. D., 847.
Langmuir, I. C., 799.
Lanphear, M. O., 421.
Lansburgh, R. H., 285.
Lantow, J. L., 373.
Lapham, E. G., 775.
Lapinskii, L. K., 857.
Lapinsky, L. K., 857.
Larrimer, W. H., 254.
Larsinos, G. J., 316.
Larson, G. A., 14.
Larson, G. L., 280.
Larson, W. P., 70, 271.
Lassar-Cohn, 609.
Lathrop, A. W., 257.
Latimer, L. P., 138, 139.
Latimer, W. J., 421.
Latshaw, W. L., 227.
Latzke, A., 698.
Laubert, R., 532.
Laude, H. H., 396.
Lauer, K. W., 224.
Lauprecht, E., 820.
Laurie, A., 41, 599.
Lauritzen, J. I., 49
Lauterbach, 273.
Lawler, B. M., 265.
Lawrence, D. A., 69.
Lawrence, J. S., 284.
Lawrence, W. J. C., 428.
Lawrow, B. A., 293.
Leach, J. G., 239.
Lean, O. B., 450.
Lebedincev, E., 424.
Lebermann, F., 410.
Ledingham, J. C. G., 469.
Lee, A. M., 873.
Lee, A. R., 258.
Lee, H. A., 99, 828, 829.
Lee, J. G., jr., 290.
Leer, A. van, 332.
Leersum, E. C. Van, 592.
Lees, A. H., 532.
Leeuwen, E. R. Van, 458.
Legezynski, S., 372.
Leggatt, C. W., 225.
Legge, A., 302.
Legge, J. T. H., 575.
Lehman, S. G., 744.
Lehmann, E., 215.
Lehmann, E. W., 179, 878.
Lehmann, J. V., 300.
Leigh-Clare, J., 894.
Leighton, G., 587.
Leighty, C. E., 182, 327, 638.
Leishman, E., 232.
Leitch, I., 590.
Leith, B. D., 127.
Le Louet, G., 73.
Lemaire, M. N., 567.
Lengyel, G., 639.
Lennox, C. G., 829.
Lentz, G. H., 838.
Lenz, M., 628, 827.
Leonard, M. D., 252.
Lepeschkin, W. W., 625, 626.
Lepik, E., 300.
Lepkovsky, S., 92.
Lerche, 874.
Lesley, J. W., 387.
Lesley, M. M., 326.
Lestoquard, F, 175.
Leuenberger, F., 455.
Levin, O. R., 838.
Levy, E. B., 632.
Lewicki, S., 226, 829.
Lewis, A. H., 203.
Lewis, E. B., 879.
Lewis, H. B., 191.
Lewis, H. C., 249, 255.
Lewis, H. G., 17.
Lewis, H. R., 100.
Lewis, M. S., 587.
Lewis, R. O., 396.
Lewis, W. E., 834.
Lieb, C. W., 589.
Lieske, R., 535, 803.
Light, S. F., 356.
Lignières, 473.
Lilienstern, M., 818.
Lill, J. G., 83.
Lilleland, O., 335.
Lima, A. da C., 856.
Limbourn, E. J., 534.
Liming, 444.
Lindow, C. W., 612.
Lindsey, J. B., 866.
Lindstrom, E. W., 894.
Line, R., 808.
Linford, M. B., 499.
Lingelsheim, A. von, 625.
Lininger, F. F., 285.
Link, G. K. K., 242.
Link, K. P., 148, 537.
Linsbauer, K., 213, 325.
Linsley, C. M., 624.
Lipman, C. B., 28.
Lipman, J. G., 285, 381, 399, 714, 724, 797.
Lipp, J. W., 246, 252.
Lipperheide, G., 427.
List, G. M., 151.
Little, G. W., 261.
Lively, C. E., 882.
Livesay, E. A., 162.
Livingston, B. E., 21.
Livingston, L. F., 625.
Lloyd, D., 687.

Lloyd, J. W., 87, 788, 836.
Lloyd, O. G., 395, 578, 579.
Lochead, D. C., 70.
Lockwood, E. K., 437.
Lodewick, J. E., 815.
Loeffel, W. J., 257.
Logan, C. A., 177, 395.
Lombard, P. M., 635.
Long, G. H., 884.
Long, J. D., 376.
Longwell, J. H., 257, 460, 691.
Loo, T. L., 516, 627.
Loomis, H. F., 745.
Lopez, A. G., 50.
Lopez, A. W., 756.
Lorenz, P., 429.
Love, H. H., 216, 222, 223, 527, 898.
Low, J. S., 666.
Lowry, P. R., 158, 854.
Lucas, D. B., 681.
Lucas, P. S., 67, 779, 808.
Luijk, A. van, 51.
Lundblad, O., 54.
Lundin, H., 415.
Lundquist, G. A., 385.
Lush, J. L., 759.
Lush, R. H., 97, 396.
Lüstner, G., 841.
Lutman, A. S., 34.
Lutz, E., 375.
Lykhvar, D. F., 220.
Lyness, W. E., 129.
Lynott, M. L., 798.
Lyons, E. S., 396.

Mabee, W. B., 153.
McAllister, L. C., jr., 547.
McAlpine, J. G., 257, 299, 410, 475, 674.
McAtee, W. L., 449, 546.
McBain, J. W., 708.
McCall, A. G., 100, 899.
MacCallum, W. G., 567.
McCampbell, C. W., 159, 257.
McCarrison, R., 595.
McCarty, M. A., 60.
McCay, A. C., 372.
McClelland, C. K., 122, 330, 331, 827.
McClendon, J. F., 398.
McClintock, B., 215.
McClintock, J. A., 229, 232.
McClintock, M., 372.
McClure, J. T., 56.
McCollam, M. E., 29.
McColloch, J. W., 899.
McCollum, E. V., 87, 890.
McComas, E. W., 78, 759.
McCool, M. M., 18, 118.
McCord, J. E., 286.
McCormick, F. A., 849.
McCormick, L. M., 595.
McCory, S. H., 899.
McCoy, E., 107.
McCray, H. E., 681.
McCrea, A., 628.
McCulloch, E. C., 772, 871.
McCulloch, L., 240.
McCulloch, R. W., 687.
McDaniel, E. I., 57, 753.
MacDaniels, L. H., 643.
McDonald, F. G., 764.
McDonald, W. F., 813.
McDonnell, C. C., 544.
MacDougall, R. S., 547.
MacDowell, E. C., 632.
McDowell, M. S., 285.
McElhanney, T. A., 278.
McFall, R. J., 284.
McFarland, J., 357.
McGeorge, W. T., 208.
McGilliard, P. C., 257.
MacGillivray, A. D., 661.
MacGillivray, J. H., 441, 643.
McGlashan, H. D., 772.
McGregor, E. A., 754.
McGrew, T. F., 667.
McGuffey, V., 579.
Machlis, J. A., 14.
McIlvaine, T. C., 136.
McIndoo, N. E., 660.
MacInnes, D. A., 708.
McIntyre, A. C., 740.
Mackay, C. H., 200.
McKay, H., 489, 492, 585.
Mackay, J. W., 200.
McKay, R., 47, 241.
McKee, J. M., 284.
McKelvie, S. R., 302.
McKenzie, F. F., 257.
Mackenzie, J. K., 881.
McKerral, A., 174.
McKibben, E. G., 376.
McKibbin, R. R., 206.
Mackie, F. P., 194.
Mackie, W. W. 344, 437.
McKinley, E. B., 269, 568, 871.
MacKinney, A. L., 647.
McKittrick, E. J., 192, 693.
McLachlan, T., 387.
McLane, J. W., 426.
McLaughlin, L. I., 89.
McLaughlin, W. W., 477.
McLean, F. T., 533.
McLean, H. C., 526.
MacLennan, K., 292, 890.
MacLeod, G. F., 555.
McMurtrey, J. E., jr., 218, 243, 477.
McNall, P. E., 181.
McNary, C. L., 285.
M'Naughton, E. J., 846.
McNeal, W. B., 299.
MacNeilage, A., jr., 887.
McNutt, J. C., 900.
McNutt, S. H., 78, 278.
Macoun, W. T., 100, 648.
McRobert, G. R., 383.
McRostie, G. P., 31, 32.
McVey, F. L., 199.
McWhorter, F. P., 746.
Macy, I. G., 292, 493.
Maddock, S. J., 893.
Maddox, R. S., 290.
Madsen, 175.
Madsen, D. E., 200.
Madson, B. A., 224, 327, 328.
Magalhaes, O., 378.
Magill, E. C., 690.
Magistad, O. C., 619.
Magness, J. R., 40, 500.
Magoon, C. A., 38, 214.
Magrou, J., 720.
Magruder, R., 440, 835.
Malcolm, J., 692.
Malinowski, E., 215, 630.
Mallmann, W. L., 411.
Malloch, J. G., 808.
Manas y Cruz, M., 830.
Manchester, A. W., 288.
Manen, E. van, 560.
Maney, T. J., 231, 427.
Mangelsdorf, A. J., 829.
Mangelsdorf, P. C., 216, 221, 633.
Manifold, J. A., 278.
Mann, A. R., 200, 579.
Mann, H. B., 84, 622, 812.
Mansfield, H., 173.
Manter, H. W., 574.
Manwell, E. J., 631.
Marble, D. R., 669.
Marchal, P., 547.
Marchionatto, J. B., 841.
Marcussen, W. H., 265.
Markee, J. E., 631.
Marlatt, A. L., 194, 195.
Marples, E., 795.
Marquis, J. C., 688.
Marriott, McK., 588.
Marsais, P., 50.
Marsh, C. D., 70.
Marsh, H., 272, 856.
Marsh, M. E., 693.
Marsh, T. D., 529.
Marshall, H. L., 321.
Marshall, R. E., 40, 290.
Marston, A. R., 454, 496, 851.
Marston, H. W., 159, 699.
Marti, W. C., 697.
Martin, C., 469.
Martin, C. W., 587.
Martin, G. W., 748.
Martin, H., 545.
Martin, H. M., 768.
Martin, J. C., 208.
Martin, J. H., 688.
Martin, S. H., 211.
Martin, T. L., 510.
Martin, W. H., 742, 748, 842, 845.

Martin, W. McK., 200.
Martin, W. R., jr., 141, 354.
Martinaglia, G., 69, 275, 375.
Martley, J. F., 530.
Martyn, E. B., 227.
Maruta, S., 549.
Marvin, C. F., 614.
Marvin, T. O., 584.
Massengale, O. N., 397, 667, 763.
Matheson, D. C., 572.
Matheson, R., 246.
Mathews, F. P., 861.
Mathiesen, H. A., 766.
Matsumoto, T., 800.
Matsumura, S., 896.
Matsushima, S., 895.
Matthew, E. B., 290.
Matthews, A. E., 618.
Mattick, E. C. V., 264.
Matzko, S. N., 293.
Maughan, G. H., 795, 796, 865.
Maurizio, A. M., 215.
Maximow, N. A., 424.
Maxton, J. P., 683, 883.
May, C., 439.
Mayhew, R. L., 98.
Maynard, E. J., 760.
Maynard, L. A., 257.
Mead, E., 381.
Means, R. H., 397.
Medalla, M. G., 829.
Megee, C. R., 34.
Megrall, E., 677.
Mehlig, J. P., 108.
Mehring, A. L., 814.
Meier, F. C., 132, 746.
Meier, N. F., 854.
Meinel, K., 815.
Meinzer, O. E., 476, 773.
Melchers, L. E., 46, 239, 396, 445.
Mellanby, E., 894.
Melrose, J., 600.
Mendel, L. B., 291, 594.
Mensching, J. E., 398.
Menzel, R., 658, 753.
Mercer, W. B., 884.
Merchant, C. H., 183, 283.
Merrill, A. C., 67.
Merrill, E. D., 394, 395.
Merrill, F. A., 156.
Merrill, S., jr., 527.
Merriman, M., 691.
Merz, A. R., 813, 814.
Métalnikov, S., 662.
Metcalf, Z. P., 752.
Metivier, H. V., 263.
Metz, C. W., 822.
Metzger, H., 579, 786.
Metzger, W. H., 511.
Meunier, K., 753.
Meurs, A., 300.
Meyer, A. H., 98.
Meyer, A. W., 595.
Meyer, H. D., 579.
Meyers, H. H., 100.
Meyers, M. T., 56.
Mez, G., 326.
Michaelis, L., 610.
Mickle, F. L., 674.
Middleton, T., 400.
Midgley, A. R., 128, 200.
Mighell, R. L., 784.
Mihailesco, M., 71.
Milad, Y., 816.
Millar, C. E., 416.
Miller, A. R., 599.
Miller, A. W., 570.
Miller, D. F., 855.
Miller, D. G., 76.
Miller, F. W., 752.
Miller, J. C., 98.
Miller, L. B., 208.
Miller, M. F., 810, 883.
Miller, M. P., 735, 736.
Miller, P. L., 578.
Miller, P. W., 148.
Miller, R. B., 645.
Miller, R. C., 257, 790, 791.
Miller, R. F., 259.
Miller, R. J., 398, 667.
Miller, R. L., 548, 552, 754.
Milles, B. L., 630.
Mills, W. D., 150.
Milton, W. E. J., 29.
Minnich, D. E., 546.
Mistikawy, A. M., 657.
Mitchell, D. R., 181.
Mitchell, H. H., 9, 70, 389, 461.
Mitchell, S. L., 403.
Mitchener, A. V., 452.
Miyamoto, T., 570, 571.
Mohr, J. C. van der M., 549.
Monier-Williams, G. W., 812.
Monfiushko, V. A., 235.
Monjuschko, V. A., 235.
Monjushko, V. A., 235.
Monroe, C. F., 465, 466.
Monteith, J., jr., 649.
Montgomery, E. G. 284.
Montgomery, L. M., 290, 835.
Mooers, C. A., 127, 140, 197.
Moon, H. H., 612.
Moon, J. W., 17.
Moore, A. N., 579, 685.
Moore, C. N., 495.
Moore, E. G., 499.
Moore, H. R., 482.
Moore, J. C., 516.
Moore, R. L., 683.
Moore, T., 297, 793.
Moore, V. A., 70.
Moore, W., 70.
Moorhouse, L. A., 81.
Mordvilko, A., 550.
Morency, H. L., 508.
Morgan, A. F., 400.
Morgan, D. O., 374.
Morgan, G. F. V., 266.
Morgan, M. F., 622, 637.
Morgan, M. T., 888.
Morgan, R. S., 292.
Morinaga, M., 800.
Morita, H., 870.
Morland, D. M. T., 360.
Morrill, J. S., 405.
Morris, O. B., 29.
Morrison, B. Y., 739.
Morrison, F. B., 163.
Morrow, K. S., 66, 67.
Morse, F. W., 401, 810, 832
Mortimer, G. B., 128.
Morton, F. A., 656.
Moseley, T. W., 669.
Moses, B. D., 335, 376.
Moses, M. S., 822.
Moss, W. L., 268.
Mote, D. C., 55.
Motherwell, W. R., 371, 849
Mothes, K., 22.
Mottram, V. H., 894.
Moulton, C. R., 257, 664.
Moulton, D., 850.
Mowry, H., 739, 837.
Mowry, M. C., 334.
Moznette, G. F., 553.
Muckenfuss, R. S., 274.
Mudge, C. S., 265.
Muir, W. A., 757.
Mulford, F. L., 530.
Müller, E., 308.
Muller, H. J., 215, 218, 82
Muller, J. F., 207.
Mulvey, R. R., 207, 220.
Mumford, H. W., 483, 487.
Munce, T. E., 70.
Muncie, J. H., 397.
Mungomery, R. W., 658.
Munn, M. T., 441.
Munsell, H. E., 895.
Murlin, J. R., 693.
Murneek, A. E., 40.
Murphy, D. F., 713.
Murphy, H. F., 317.
Murphy, P. A., 47, 241, 46
Murray, C., 70, 73, 257, 27
Murwin, H. F., 136, 40
844.
Musbach, F. L., 118, 119.
Muse, J. K., 67, 170, 46
408, 562, 873.
Mussehl, F. E., 63, 175, 86
Musselman, H. H., 475, 77
Mutchler, A. J., 855.
Muth, F., 213.
Myers, H. E., 396.
Myers, J. G., 850.
Myers, P. B., 610.
Myers, R. P., 411.
Myers, V. C., 590.
Myrick, E., 756.

Nabours, R. K., 396.
Nagant, H. M., 206.
Nakamura, H., 654.

Nakamura, J., 568.
Nakamura, N., 372, 870.
Nakanishi, S., 568.
Nakayama, S., 549, 753.
Nance, R. E., 762.
Narayanamurti, D., 11.
Nash, A. W., 379.
Nash, J. A., 404.
Navashin, M., 326.
Neal, W. M., 198.
Neatby, K. W., 629.
Nebel, B. R., 24, 398, 517.
Needham, J. G., 548.
Neel, L. R., 127.
Negaard, O. A., 85.
Neilson, J. A., 525.
Neiswander, C. R., 56, 450.
Neiswander, R. B., 450.
Nelms, E. B., 290.
Nelson, A. L., 180.
Nelson, C. I., 25.
Nelson, D. H., 623.
Nelson, D. W., 280.
Nelson, E. K., 804.
Nelson, O. A., 545.
Nelson, P. M., 494, 495.
Nelson, P. R., 209.
Nelson, R., 443, 449, 842.
Nelson, T. C., 748.
Nelson, V. E., 591, 597.
Nesom, G. H., 331.
Neumann, R. O., 190.
Neveu-Lemaire, M., 567.
Newburgh, L. H., 889.
Newcomb, C., 590.
Newcomer, E. J., 157, 660.
Newell, H. M., 836.
Newell, W., 659.
Newhall, A. G., 397, 444.
Newins, H. S., 398.
Newlander, J. A., 257.
Newman, L. H., 220, 830.
Newman, W. S., 290.
Newton, D., 575.
Newton, E. B., 807.
Newton, H. C. F., 354.
Newton, M., 237.
Newton, R., 300.
Newton, R. W., 899.
Nicholas, J. E., 398.
Nickell, P., 299.
Niemann, K. W., 73, 200, 876.
Nieschulz, O., 660.
Niethammer, A., 516.
Niimi, K., 571, 572.
Nikol'skii, G. A., 472.
Nill, W., 214.
Nishikado, Y., 538, 539.
Nisonger, H. W., 299.
Nissen, B. H., 563, 866.
Nissley, C. H., 522.
Noack, M., 532, 813.
Noble, J. H., 257.
Nobles, C. R., 758.
Noguchi, H., 55, 854.
Nohmi, S., 573.
Nojima, T., 847.
Noll, C. F., 436.
Norris, R. V., 11.
North, H. F. A., 900.
Norton, L. J., 484.
Norton, W. J., 395.
Novák, V., 613.
Nowak, J., 720.
Nuckols, S. B., 331.
Nunn, R., 313.

Oakley, H. B., 506.
Oard, H. C., 269.
O'Brien, D. G., 846.
O'Brien, G., 578.
O'Brien, R., 497.
O'Byrne, W., 885.
Odland, T. E., 518, 520.
O'Donnell, F. J., 656.
Oehler, E., 300.
Oesper, R. E., 609.
Ogilvie, L., 354, 654.
Oguni, H., 571, 870.
Ogura, K., 673.
O'Hara, E. V., 579.
Okajima, G., 753.
Okamura, T., 520, 895.
O'Kane, W. C., 153, 154.
Olcott, M. T., 100.
Oliveiro, C. J., 293.
Oliver, H., 599.
Olney, A. J., 835.
Olsen, N. A., 688.
Olson, T. M., 561.
O'Neal, A. M., 16.
Ono, S., 574, 676.
Opitz, K., 808.
Oppermann, 273.
Orloff, A. N., 857.
Orlov, A. N., 857.
Orr, J. B., 371, 590.
Orr, P. F., 674.
Orrben, C. L., 15.
Orton, C. R., 398.
Orwin, C. S., 884.
Osborn, C. S., 598.
Osborn, H., 249.
Osborne, T. B., 291, 547.
Oser, B. L., 94.
Oskierski, H. U., 719.
Osland, H. B., 760.
Oslund, R. M., 630.
Ossent, H. P., 300.
Osterberger, C. L., 397.
Osterhout, W. J. V., 513, 741.
Otsuka, K., 870.
Outhouse, J., 292, 493.
Overholser, E. L., 835, 876, 395, 700.
Overman, O. R., 466.
Owen, B. J., 275, 881.
Owen, W. L., jr., 556.
Pack, H. J., 54.
Pagliano, T., 253.
Paillot, A., 55, 547, 856.
Paine, F. D., 478, 579.
Paine, L. S., 15, 617.
Painter, J. H., 37, 38, 177, 441, 442, 525, 580, 837.
Palmer, C. C., 675.
Palmer, E. F., 527.
Palmer, L. S., 491, 597.
Palmer, T. W., 859.
Pammel, L. H., 873.
Panfilov, S. B., 672.
Panphiloff, S. B., 672.
Panshin, B. A., 828.
Papish, J., 888.
Park, J. W., 187.
Park, W. H., 272.
Parker, E. C., 129.
Parker, F. W., 198.
Parker, H. L., 253.
Parker, J. H., 226.
Parker, J. R., 153, 656.
Parker, M. M., 542, 740, 746.
Parker, R. R., 656, 657, 856, 871.
Parker, S. L., 365.
Parker, T. J., 847.
Parkes, A. S., 258.
Parks, R. R., 879.
Parmenter, H. S., 591.
Parr, V. V., 759, 779.
Parrot, L., 175.
Parrott, P. J., 155, 398.
Parshall, R. L., 276.
Parson, H. E., 343.
Parsons, C. H., 257.
Parsons, C. L., 799.
Parsons, T. R., 306.
Partridge, A., 405.
Partridge, N. L., 739.
Paschall, A. H., 418.
Patch, A. J., 498.
Patch, L. H., 253.
Paterson, J. W., 489.
Patt, E. M., 732.
Patterson, C. F., 527.
Patterson, H. J., 898.
Patterson, W. H., 450.
Patton, C. A., 416.
Patton, H. S., 599.
Patwardhan, V. N., 11.
Paul, B. H., 277.
Paula, J. T., 379.
Payne, L. F., 464, 874.
Peabody, L. E., 177.
Peacock, W. M., 635.
Peairs, L. M., 441.
Pearl, R., 358, 514.
Pease, H. C., 599.
Peavy, G. W., 531.
Peck, M., 285, 598.
Peck, M. E., 397.
Pedlow, J. T., 781.
Peebles, R. H., 826.

Peirce, G. J., 627.
Pekelo, N. K., 666.
Peklo, J., 22.
Pelaghias, C. G., 548.
Peluffo, A. T., 250.
Penning, C. J. H., 829.
Peralta, F. de, 719.
Pereyra, A., 632.
Perkins, A. E., 465, 466.
Perkins, S. O., 16, 17, 112.
Perkins, W. R., 433, 446, 498.
Perov, S. S., 766.
Perregaux, E. A., 287.
Perrin, O., 356.
Perry, E. S., 278.
Persons, L., 397.
Pessin, L. J., 819.
Peter, A. M., 199.
Peters, W. H., 258.
Peterson, A., 251, 661.
Peterson, E. C., 497.
Peterson, G. M., 285.
Peterson, W., 76, 96.
Peterson, W. H., 107, 712.
Petherbridge, F. R., 850.
Peto, F. H., 721.
Petri, L., 300.
Petrie, A. H. K., 308.
Pettersson, W. J., 416.
Pettey, F. W., 233, 756, 757.
Pettit, R. H., 449, 656.
Phelps, T. R., 873.
Phillips, E. F., 157.
Phillips, H. D., 688.
Phillips, J. C., 99.
Phillips, J. F. V., 42.
Phillips, S. W., 17, 616, 809.
Phillips, T. G., 59, 116, 117, 120, 126, 138.
Phipps, C. R., 254.
Picard, W. K., 74.
Pickett, B. S., 231.
Pickett, W. F., 141.
Pieper, G., 300.
Pigott, M. G., 294, 795.
Pigott, R. J. S., 476.
Piippo, A. F., 111, 614.
Pilchard, E. I., 190.
Pillsbury, G. P., 285.
Piney, A., 297.
Pinner, L., 225.
Pinner, M., 70.
Pinto, H. E., 574.
Piper, S. E., 350.
Pitcairn, R. C., 828, 829.
Pittman, B. C., 797.
Pittman, D. W., 20, 27.
Pittman, M. S., 579.
Plank, H. K., 550, 851.
Platt, C. S., 62, 367, 863.
Platz, G. A., 818.
Plaut, M., 828.
Plumb, C. S., 200.
Poggi, E. M., 95.
Poher, E., 282.
Poisson, R., 250.
Poletika W. v., 416.
Polivka, J. B., 56, 454.
Pollock, R. C., 664.
Poole, R. F., 84, 346, 447, 744, 745.
Poos, F. W., 250, 350.
Pope, J. D., 578.
Pope, W. T., 732.
Popp, H. W., 324.
Porodko, T. M., 629.
Porsch, O., 628.
Porter, J., 884.
Porter, T. W. McD., 600.
Poston, M. A., 674.
Potter, G. F., 138, 139, 180.
Potts, R. C., 688.
Potts, S. F., 547.
Poulsson, E., 894.
Poutiers, R., 547.
Powell, B. B., 887.
Powell, H., 397.
Powell, H. C., 529.
Powers, W. L., 20, 422, 423.
Prange, R. W., 63.
Pratt, L. A., 799.
Predtechenskii, S. A., 354.
Predtetshenskij, S. A. 354.
Pressley, E. H., 639.
Preston, I., 530.
Preuss, L. M., 712.
Price, F. E., 79.
Price, H., 723.
Price, H. B., 85, 199, 579, 585, 786.
Price, H. L., 713.
Price, W. A., 598.
Prickett, L. C., 881.
Prideaux, E. B. R., 806.
Prikladowizky, S., 413.
Prince, F. S., 117, 126.
Priston, W. H., 267.
Pritchett, I. W., 770.
Prjanischnikow, N. D., 310.
Proebsting, E. L., 335, 420.
Prokes, A., 285.
Prucha, M. J., 563.
Pruess, L. M., 107.
Pucher, G. W., 491.
Pulley, M. G., 200.
Purwin, P., 73, 273.
Pussard, R., 550.
Putnam, G. W., 498.

Quayle, H. J., 395, 659.
Quencer, A. B., 567.
Quennel, W., 614.
Queenberry, J. R., 457.
Quinby, J. R., 521.
Quirke, T. F., 567.
Quisenberry, K. S., 131, 517, 638.
Quizon, P., 829.
Rahlen, H., 584, 887.
Raeder, J. M., 533.
Raeder, L. D., 199.
Rahn, O., 265.
Raisch, E., 679.
Ram, M. G., 899.
Ramakrishna Ayyer, T. V., 452.
Ramsay, J. M., 289.
Ramsdell, L. A., 579.
Ramsey, G. B., 48.
Randall, R., 678.
Rankin, A. C., 300.
Rankin, J. O., 196.
Rao, K. K., 332, 636.
Rapin, J., 843.
Rasmussen, E. J., 154.
Rather, H. C., 330.
Ratliffe, G. T., 446.
Ratner, G., 887.
Rau, P., 58.
Rawlins, T. E., 514.
Rayner, A., 802.
Rayner, M. C., 514.
Rayns, F., 884.
Rea, H. E., 826.
Rea, M. W., 211.
Reck, S. S., jr., 599.
Reed, C. O., 683.
Reed, G. M., 842.
Reed, H. J., 394.
Reed, H. S., 395.
Reed, L. J., 630.
Reed, O. E., 105, 262, 464.
Rees, J., 29.
Rees, L. W., 646.
Reeves, R. G., 516.
Regan, W. M., 467.
Regan, W. S., 251.
Regeimbal, L. O., 24, 517.
Regnier, R., 547.
Reh, L., 532.
Rehmann, E., 530.
Reid, J. W., 884.
Reid, W. H. E., 887.
Reimer, F. C., 526.
Reineke, L. H., 235.
Reinhold, J., 834.
Remesow, I., 203.
Remy, E., 295.
Renick, B. C., 773.
Rettger, L. F., 70, 257, 475.
Reynolds, E. B., 729.
Reynolds, E. S., 47.
Rhine, J. B., 823.
Rhoad, A. O., 258.
Rhodes, F. H., 897.
Rhynehart, J. G., 669.
Rice, J. B., 460.
Rice, J. E., 869.
Rice, W. H., 800.
Richards, B. L., 44.
Richards, G., 128, 205.
Richardson, A. H., 531.
Richardson, H. B., 591.

Richart, F. E., 477.
Richert, P. H., 387, 412.
Richmond, E. A., 555.
Richmond, T. E., 325.
Richter, C., 728, 790.
Riddell, F. T., 288, 482.
Riddell, W. H., 396.
Ridenour, G. M., 397.
Riedmüller, L., 375, 471.
Riehm, E., 343, 532.
Riffenburg, H. B., 773.
Rigney, J. W., 37.
Riker, A. J., 147, 14
Riker, R S., 147.
Riley, H. K., 663.
Riley, H. W., 576.
Riley, P. B., 174.
Rinear, E. H., 180, 885.
Rinjard, P., 471, 472.
Rippas, P. de, 253.
Ripperton, J. C., 723, 790.
Rischkow, V., 214, 542.
Ritson, K., 515.
Ritzman, E. G., 857.
Rivers, T. M., 274.
Rivkin, H., 295, 596.
Ro, L. M., 526.
Roark, R. C., 543, 545.
Robbins, B. H., 678.
Robbins, E. T., 258.
Robbins, F. S. R., 392, 393.
Robbins, P. W., 42, 43.
Robbins, W. R., 734.
Robbins, W. W., 225, 512, 523.
Robert, S. A., 127, 140.
Roberts, E. A., 530.
Roberts, E. H., 500.
Roberts, J. W., 244, 845.
Roberts, O. C., 833.
Roberts, O. S., 732.
Roberts, R. A., 29, 30, 518.
Roberts, R. E., 65.
Robertson, D. W., 520.
Robertson, G. S., 667.
Robinson, C. S., 420.
Robinson, D. H., 848.
Robinson, E. M., 69.
Robinson, F. W., 697.
Robinson, J. L., 220.
Robinson, J. M., 453.
Robinson, R. H., 40, 541.
Robinson, W. O., 512.
Robinson, W. L., 257, 463.
Robscheit-Robbins, F. S., 392, 393.
Roche, B. H., 160, 161, 163, 169.
Rochester, G. H., 279.
Rochette, 529.
Rodenwold, B. W., 684.
Roderick, L. M., 72.
Roe, G. C., 70.
Roemer, T., 300.
Roethe, H. E., 479.
Rogers, C. F., 626, 732.
Rogers, C. G., 819.
Rogers, H. W., 665.
Rogers, R. H., 782.
Rogers, W. B., 119.
Roh, L. M., 526.
Rohde, G., 300.
Rohwer, S. A., 661.
Rolle, M., 470.
Rollins, H. A., 138.
Romary, A., 73.
Romburgh, P. van, 699.
Rommel, G. M., 285.
Root, H. F., 195.
Rosa, J. S., 357.
Rosasco, J., 327.
Roscoe, M. H., 710.
Rose, M. S., 87, 589.
Rose, W. B., 193, 895.
Rose, W. C., 89.
Rosedale, J. L., 293, 306.
Rosen, H. R., 650.
Rosenau, M. J., 381.
Rosenheim, O., 416, 894.
Ross, I. C., 267, 372, 874.
Ross, R., 554.
Ross, W. H., 814.
Rostrup, S., 547.
Rothgeb, B. E., 33.
Rowaan, P. A., 549.
Roxas, M. L., 828, 829.
Rozman, D., 283.
Rudolfs, W., 55, 210, 480, 661, 780.
Ruehe, H. A., 869.
Ruffner, R. H., 768.
Rümker, K. von, 300.
Rundle, D. H., 851.
Runnells, R. A., 677, 768.
Runnels, H. A., 174.
Rupel, I. W., 128, 168, 169, 308.
Rush, B., 403.
Russel, J. C., 518.
Russell, E. J., 381.
Russell, J., 884.
Russell, S. W., 285.
Rust, E. W., 351, 357.
Rutten, L. M. R., 699.
Ruttle, M. L., 239.
Ruzek, C. V., 422.
Ryder, E. H., 579.
Ryerson, K. A., 381.
Ryssselberge, P. J. Van, 708.

Sackett, W. G., 115.
Sackville, J. P., 259.
Sadler, W., 369.
Safro, V. I., 555, 855.
Saillard, E., 225.
St. George, R. A., 453, 737.
St. John, J. L., 586.
Salaman, R. N., 469.
Salem, I. F., 871.
Salmon, E. S., 537, 648.
Salmon, W. D., 12, 91.
Salter, R. M., 56, 483.
Sammis, J. L., 171.
Sammons, E. C., 599.
Sampson, H. C., 56.
Sanborn, J. R., 810.
Sandberg, E., 369.
Sandels, M. R., 592, 593.
Sanders, D. A., 876.
Sanders, E. F., 677.
Sanders, E. P., 269.
Sanders, H. G., 263.
Sandsten, E. P., 136.
Sanford, J. R., 393.
Sankaran, G., 590.
Sanmann, F. P., 466.
Sanyal, P., 503.
Sarles, B. W., 766.
Sartoris, G. B., 121.
Sasaki, K., 262.
Sauve, E. C., 78.
Savage, D. A., 724, 733, 761.
Savage, J. R., 56.
Savastano, G., 215, 747.
Saville, R. J., 98, 578.
Sawhney, A., 535.
Sawyer, C. E., 572.
Sawyer, F., 711.
Sawyer, W. H., 850.
Sawyer, W. H., jr., 256.
Sayle, M. H., 350.
Sayre, C. B., 834.
Sayre, J. D., 444, 445, 819, 842.
Scarth, G. W., 121.
Schaaf, J., 876.
Schaars, M. A., 181.
Schaffer, J. M., 410.
Schaffner, J. H., 428.
Schaffnit, E., 300, 533, 843.
Schalk, A. F., 70, 72.
Schander, 538.
Schander, R., 841.
Schermer, S., 873.
Schermerhorn, L. G., 523 734.
Scheunert, A., 293.
Schieblich, M., 293.
Schilling, S. J., 870.
Schilling, W. F., 302.
Schimamura, T., 567.
Schlenker, F. S., 59, 120 599.
Schlingman, A. S., 674, 678
Schlubatis, G. R., 200.
Schmaus, L. F., 663.
Schmidt, C. R., 490.
Schmidt, E., 538.
Schmidt, E. W., 346.
Schmidt, J. P., 299.
Schmidt, R., 34, 447, 725 735.
Schmieder, R., 809.
Schneck, H. W., 140.
Schneider, W., 349.
Schneiderhan, F. J., 99, 347
Schoene, W. J., 752.
Schoenthal, L., 588.

Schollander, E. G., 726, 735, 764, 797.
Scholz, H. F., 520.
Scholz, K., 284.
Schopfer, W. H., 814.
Schopmeyer, C. H., 298.
Schoth, H. A., 32, 638.
Schott, F. N., 598.
Schoubye, N., 794.
Schrader, A. L., 644.
Schreus, H., 412.
Schroeder, E. C., 271.
Schüepp, O., 325.
Schulek, E., 311.
Schulte, J. I., 96, 699.
Schulte, R. B., 732.
Schultz, L. C., 395.
Schultzer, P., 793.
Schulz, 479.
Schulz, F., 884.
Schumacker, C. E., 395.
Schuster, C. E., 442, 685.
Schuttler, V. B., 579.
Schwantes, A. J., 774.
Schwarte, L. H., 99.
Schwartz, B., 471.
Schwartz, M., 843.
Schwartz, W., 533.
Schweizer, G., 651.
Scoates, D., 275.
Scott, A. H., 500.
Scott, C. L., 699.
Scott, H. T., 164, 165.
Scott, J. L., 847.
Scott, J. P., 396.
Scott, R. C., 334.
Scott, S. G., 58.
Scott, W. M., 855.
Scudder, H. D., 684.
Seamans, A. E., 724, 733, 760.
Sears, F. C., 832, 838.
Seddon, H. R., 71.
Seeley, B. D., 81.
Seeley, D. A., 416.
Seham, G., 591.
Seham, M., 591.
Seidell, A., 710.
Seifried, O., 876.
Selby, H. E., 582, 684, 685, 784.
Semple, A. T., 759.
Sendroy, J., jr., 805.
Sergent, E., 175.
Serinis, N. S., 108.
Severin, H. H. P., 238, 242, 852.
Sewell, A., 299.
Shady, S. S., 336.
Shannon, R. C., 55, 854.
Shantz, L., 99.
Shapiro, C. V., 865.
Shapovalov, M., 243.
Shaw, C. F., 814, 815.
Shaw, F. J. F., 29, 222.
Shaw, J. K., 882.
Shaw, J. N., 768, 856.
Shaw, L., 650.
Shaw, N., 799.
Shaw, R. S., 498.
Shawl, R. I., 681.
Shearer, P. S., 257.
Shearer, R., 12.
Sheets, E. W., 257, 457.
Shepperd, J. H., 257.
Sherbakoff, C. D., 147.
Sherburne, R. E., 284.
Sherfy, C. B., 100.
Sherman, F., III, 556.
Sherman, H. C., 90, 592, 694.
Sherman, H. E., 394, 586, 589, 592, 595, 894.
Sherman, J. M., 587.
Sherman, W. A., 187, 285, 584, 688.
Sherwood, E. C., 441.
Shibuya, J., 55.
Shibuya, K., 800.
Shimer, S. R., 139.
Shipley, R. A., 590.
Shipp, H. L., 296.
Shiratori, K., 800.
Shoemaker, J. S., 439.
Sholl, L. B., 468.
Shtakel'berg, A. A., 354.
Shull, G. H., 215.
Shunk, I. V., 508.
Sideris, C. P., 499.
Siegler, E. H., 252.
Siemens, H. J., 633.
Sievers, A. F., 140.
Sievers, F. J., 898.
Sigfusson, S. J., 721.
Silfversparre, A., 369.
Silver, E. A., 478.
Simmonds, J. H., 845.
Simmonds, N., 87.
Simms, B. T., 74, 856.
Simonet, M., 24.
Simonik, F., 295.
Simonnet, H., 195, 596, 896.
Simpson, W. M., 269.
Sinclair, J. M., 371.
Sinclair, R. D., 666.
Singh, B. N., 816.
Singh, J., 567.
Singh Bindra, S., 253.
Sinnott, E. W., 429.
Sirks, M. J., 215.
Sitterley, J. H., 882.
Sitton, B. G., 525.
s'Jacob, J. C., 515.
Sjollema, B., 270.
Skibbe, A., 756.
Skinner, C. E., 816.
Skinner, J. H., 664.
Skinner, J. J., 118, 622, 812.
Skoric, V., 240.
Skripchinskii, G. P., 354.
Skriptshinskij, G. P., 354.
Slate, G. L., 644.
Slate, W. L., 332, 430.
Slay, R. J., 290.
Small, J., 211, 212.
Smallwood, N. W., 100.
Smee, C., 657.
Smiley, D. F., 795, 796.
Smirnow, G. G., 71.
Smith, A., 418.
Smith, A. H., 492, 694.
Smith, B., 878.
Smith, C. B., 189.
Smith, C. L., 224.
Smith, C. O., 229.
Smith, E. D., 41.
Smith, E. E., 269.
Smith, E. F., 48.
Smith, E. L., 248, 695.
Smith, F., 449.
Smith, F. B., 621.
Smith, F. C., 806.
Smith, G. E., 669.
Smith, H. B., 859.
Smith, H. S., 659.
Smith, J. M., 381.
Smith, J. O., 99.
Smith, J. R., 41.
Smith, K. M., 469.
Smith, L. B., 849.
Smith, L. H., 17, 714, 809.
Smith, L. M., 351.
Smith, L. W., 294, 795.
Smith, M. E., 696, 697.
Smith, M. R., 256.
Smith, P. H., 59, 334.
Smith, R. A., 460.
Smith, R. H., 755.
Smith, R. S., 17, 809.
Smith, R. W., 216.
Smith, S. L., 699.
Smith, T., 272.
Smith, T. O., 59, 116, 120
Smith, W. D., 520.
Smith, Z. M., 290.
Smythe, C. V., 790, 791.
Snapp, O. I., 248.
Snapp, R. R., 559.
Snedecor, G. W., 258.
Snell, G. D., 820.
Snell, K., 720.
Snow, O. W., 505.
Snyder, E. F., 12.
Snyder, J. M., 616.
Soames, K. M., 894.
Sobel, J., 596.
Somers, P. P., 697.
Sommer, A. L., 23.
Sommer, B. E., 89.
Sommer, H. H., 170, 171, 564, 766.
Sonderegger, A. L., 475.
Sorauer, P., 532.
Sorg, C. A., 898.
Sosnin, A. V., 223.
Spafford, W. J., 280.
Sparhawk, W. N., 148, 381

Spaulding, P., 51.
Speller, F. N., 878.
Spence, K. C., 92.
Spencer, A. J., 883.
Spencer, D. A., 257.
Spencer, H., 256.
Spencer, L., 579.
Spencer, R. R., 372.
Sperry, W. M., 393.
Spessivtseff, P., 557.
Speyer, E. R., 356.
Spiegel-Adolf, M., 409.
Spillman, W. J., 285.
Spilman, H. A., 339.
Spindler, L. A., 474.
Sprague, G. F., 216.
Sprague, H. B., 521, 628, 724, 827.
Sprague, T., 897.
Sproul, R. G., 299.
Spuler, A., 246, 550.
Spurway, C. H., 418.
Stackelberg, A. A., 354.
Stadler, L. J., 327.
Staehelin, M., 348.
Stafseth, H. J., 73, 468, 678.
Stahl, A. L., 198, 397.
Stakman, E. C., 533, 741.
Stallings, J. H., 224.
Stamm, A. J., 24.
Staniland, L. N., 856.
Stanley, R. E., 888.
Stansfield, R., 379.
Stanton, T. R., 25, 223, 728.
Stapp, C., 46, 532.
Starkey, R. L., 509.
Starrett, R. C., 628.
Staub, A., 875.
Stear, J. R., 546, 851.
Stearns, G., 496.
Stearns, H. T., 778.
Stearns, L. A., 450, 547, 661, 798.
Stearns, N. D., 476.
Steece, H. M., 81, 699.
Steel, E. W., 283.
Steele, (Mrs.) C. A., 579.
Steele, D. G., 97.
Steele, J., 497.
Steele, J. G., 418.
Steenbock, H., 95, 168, 195.
Stein, E., 515.
Stelzer, R. O., 600.
Stephens, A. F., 599.
Stephenson, J. W., 809.
Stephenson, R. E., 20, 209, 422.
Sterkin, E. J., 204.
Sterling, E. B., 790.
Stern, R. O., 495.
Steudel, H., 710.
Steup, H. H., 464.
Stevens, C. L., 286.
Stevens, E. H., 112.
Stevens, K. R., 507.
Stevens, N. E., 244.
Stevenson, I. M., 194.
Stevenson, W. H., 394, 421, 809.
Stewart, C. L., 284, 285, 484, 487, 579.
Stewart, E. A., 881.
Stewart, G., 20, 27, 633, 723.
Stewart, M. A., 757.
Stewart, W. A., 884.
Stewart, W. F., 299.
Stewart, W. P., 614.
Stiebeling, H. K., 87.
Stiehr, G., 214.
Stiles, G. W., 269.
Stiles, W., 212.
Still, E. U., 790.
Stillwell, E. C., 162.
Stillwell, S. T. C., 855.
Stine, O. C., 688.
Stirniman, E. J., 376.
Stitt, E. R., 870.
Stockbarger, D. C., 795.
Stockwell, P., 99.
Stokdyk, E. A., 598.
Stokes, A. P. D., 618.
Stolk, D. Van, 695.
Stoll, N. R., 848.
Stollenwerk, W., 501.
Stone, A. A., 290.
Stone, A. L., 128.
Stone, J. C., 302.
Stoppel, F., 807.
Storie, R. E., 15.
Storm, E. V., 558.
Storms, L. B., 88.
Stout, G. J., 522.
Stradling, R. E., 282.
Strahorn, A. T., 381.
Straib, W, 300.
Stratman-Thomas, W. K., 100.
Streeter, G. L., 632.
Streeter, L. R., 249, 333.
Stringfield, G. H., 445.
Stringfield, O. L., 587.
Strong, H W., 803.
Stroud, J. F., 421.
Stuart, D., 669.
Stuart, H. O., 262.
Stuart, W., 685.
Stubbe, H., 300.
Stuckey, H. P., 197.
Stucky, C. J., 193, 694, 895.
Sturgess, G. W., 871.
Sugata, H., 23.
Sugimoto, M., 574, 800.
Sure, B., 92, 696, 697, 792.
Suttie, D. F., 865.
Suzuta, I., 800.
Swaetichin, T., 309.
Swanback, T. R., 134, 719.
Swartwout, H. G., 836.
Swartz, V. W., 500.
Sweet, A. T., 14, 19.
Sweetman, H. L., 548.
Swenk, M. H., 175.
Swezey, O. H., 851, 855.
Swezy, O., 352.
Swift, F. H., 287, 888.
Swingle, C. F., 737.
Swingle, H. S., 248.
Sydenstricker, E., 597.
Szobotka, P., 476.

Taber, L. J., 285.
Taggart, J. G., 881.
Takai, M., 851.
Talbert, T. J., 141, 290.
Talbot, E. P., 393.
Taliaferro, W. H., 174, 242, 275, 568.
Tamme, C., 649.
Tanaka, T., 549, 800.
Tannehill, I. R., 614.
Tanner, F. W., 867.
Tansil, B. A., 598.
Tapp, J. W., 181.
Taubenhaus, J. J., 536.
Taylor, A. E., 314, 386.
Taylor, C. A., 504.
Taylor, C. C., 579.
Taylor, C. M., 87.
Taylor, C. V., 120.
Taylor, E. L., 350.
Taylor, F. W., 126.
Taylor, G. E., 65.
Taylor, H. C., 283, 579.
Taylor, H. V., 884.
Taylor, J., 594.
Taylor, J. C., 367.
Taylor, J. H., 878.
Taylor, M. W., 597.
Taylor, P. S., 883.
Taylor, T. H. C., 659.
Taylor, W., 567.
Tdlnow, S. M., 310.
Teague, C. C., 302.
Tehon, L. R., 52, 645.
Teller, L. W., 775, 878.
Templeton, G. S., 397.
Templeton, H. L., 170, 504.
Tenney, F. G., 620.
Terakado, Y., 567, 870.
Terzaghi, C., 477.
Thalman, R. R., 257.
Thant, U., 594.
Tharp, W. H., 399.
Thatcher, L. E., 56.
Theiler, A., 871.
Theobald, F. V., 354, 375.
Theophilus, D. R., 808.
Thomas, A. D., 69, 474.
Thomas, F. L., 556.
Thomas, H., 299.
Thomas, H. E., 150.
Thomas, M. T., 29.
Thomas, R. C., 195, 445.
Thomas, R. P., 150.
Thomas, W., 504.
Thomas, W. K. S., 100.

Thompson, B. G., 246, 851.
Thompson, H. C., 228, 290.
Thompson, H. W., 675.
Thompson, J., 70.
Thompson, J. G., 385.
Thompson, M. J., 774.
Thompson, O. A., 726, 785, 797.
Thompson, S. H., 265.
Thompson, W. C., 367, 560.
Thompson, W. R., 258.
Thomsen, F. L., 887.
Thomsen, M., 547.
Thomson, A., 111.
Thor, C. J. B., 524.
Thorfinnson, T. S., 599.
Thorne, C. E., 423.
Thornton, H. R., 99.
Thornton, N. C., 321.
Thorp, F., jr., 677, 871.
Thorvaldson, T., 300.
Throckmorton, R. I., 290.
Throssell, G. L., 534.
Thrun, F. M., 286.
Tichenko, O. D., 558.
Tiedjens, V. A., 523, 839.
Tilden, E. B., 55, 854.
Tilford, P. E., 444.
Tilley, F. W., 410.
Tillmans, J., 807.
Timberlake, P. H., 758.
Timmel, H., 120.
Timmons, F. L., 896.
Timoshenko, V. P., 184.
Tingey, D. C., 27.
Tischler, G., 215.
Tisdale, 444.
Tisdale, C. W. W., 267.
Tisdall, F. F., 391.
Tittsler, R. P., 572.
Titus, N. F., 285.
Titus, R. W., 90, 396, 491, 585, 791.
Tocher, J. F., 671.
Todd, A. C., 666.
Todd, C., 474.
Todd, F. E., 256.
Todhunter, E. N., 88.
Toit, P. J. du, 69.
Tolle, C., 257.
Tolley, H. R., 288.
Tolstoi, E., 589.
Tondus, P., 343.
Tonney, F. O., 697.
Toole, E. H., 34.
Torgerson, E. F., 428.
Toscani, V. A., 13.
Toshijima, Y., 568.
Tottingham, W. E., 13, 21, 22.
Toumanoff, 758.
Toumey, J. W., 236.
Towle, R. S., 443.
Town, B. W., 307.
Townsend, C. H. T., 247.
Tracy, P. H., 869.
Transeau, E. N., 56.
Traphagen, P. V., 398.
Traub, H. P., 39, 524.
Traum, J., 70, 270, 370, 567.
Trelease, W., 99.
Triffitt, M. J., 272.
Trimble, H. C., 898.
Trimble, R. E., 205.
Trought, T., 222.
Trout, G. M., 467.
Truax, T. R., 878.
Truche, C., 676.
True, A. C., 1, 2, 3, 4, 5, 6, 7, 8, 401, 402, 404, 405, 406, 407, 408, 489, 701, 702, 705.
Trujillo Peluffo, A., 250.
Trull, F. W., 14, 15.
Trullinger, R. W., 77, 699.
Truog, E., 114, 150.
Tschetwerikoff, N. S., 186.
Tso, E., 190, 193, 194.
Tsuge, K., 569.
Tucker, C. K., 183.
Tucker, L. R., 138, 396, 644.
Tugwell, R. G., 285.
Tukey, H. B., 229, 340, 524.
Tulaikov, N. M., 327.
Tullis, E. C., 448.
Tung-Tou Chen, 190.
Tunnicliff, E. A., 871.
Turner, A. J., 635, 698.
Turner, A. W., 873.
Turner, C. W., 169, 257, 562.
Turner, J. A., 719.
Turner, J. B., 405.
Turner, J. E. C., 582.
Turner, N., 549.
Turner, P. E., 511.
Turner, R. G., 292.
Turpin, H. W., 59.
Tuttle, A. P., 398.
Twort, F. W., 469.
Tyler, J., 349.
Tyler, J. R., 55, 854.
Tyson, M. D., 492.

Uichanco, L. B., 753, 828.
Úlehla, V., 212.
Umezu, M., 567.
Upp, C. W., 64.
Upshall, W. H., 231, 528.
Urban, H., 202.
Uri, D., 63.
Uvarov, B. P., 54.

Vacha, G. A., 517.
Vahlteich, E. McC., 589.
Vaile, J. E., 499.
Valgren, V. N., 82.
Valleau, W. D., 199.
Vallée, H., 470.
van Beyma Thoe Kingma, F. H., 51.
van der Hoeden, J., 471.
Vandervort, J., 190.
van Dieren, J. W., 285.
van Dillewijn, C., 817.
Van Dine, D. L., 256.
Van Dyke, E. C., 358.
van Elden, H., 826.
Van Es, L., 70, 768.
Van Eseltine, G. P., 513.
van Hall, C. J. J., 699.
van Leer, A., 332.
Van Leersum, E. C., 592.
Van Leeuwen, E. R., 458.
van Luijk, A., 51.
van Manen, E., 560.
van Romburgh, P., 699.
Van Rysselberge, P. J., 708.
Van Stolk, D., 695.
Van Zwaluwenburg, R. H., 357.
Varilla, P. B., 854.
Vass, A. F., 437.
Vaugh, M., 866.
Vaughan, H. C. I. G., 513.
Vaughan, R. E., 147.
Vavilov, N. I., 827.
Veatch, C., 723.
Veatch, J. O., 14, 15, 18.
Veihmeyer, F. J., 378, 503, 620.
Venkatraman, T. S., 29.
Venstrom, C., 798.
Vereshchagina, V. I., 672.
Verge, J., 275.
Vergeer, T., 273.
Verguin, J., 659.
Vernon, J. J., 885.
Verret, J. A., 829.
Vial, E. E., 210.
Viala, P., 50.
Vickery, H. B., 594.
Vidal, J., 71, 269.
Vigor, S. H., 227.
Villanueva, G., 828.
Villecz, P. von, 311.
Villiers, F. de, 756.
Vodinskaia, K. I., 354.
Vodinskaja, K. I., 354.
Voelkov, A. D., 522.
Voelter, M., 681.
Volkart, A., 227.
Vollenweider, W., 682.
Voukassovitch, P., 254, 856.

Wachs, H., 898.
Wackerman, A. E., 646.
Waddell, J., 95.
Waddill, J. T., 883.
Waggener, O. O., 258.
Wahlen, F. T., 400.
Wahlenberg, W. G., 142, 740.
Wakeley, P. C., 341, 532.
Waksman, S. A., 507, 620.
Waldo, G. F., 528.
Waldron, G. C., 499.

Waldron, L. R., 226, 521, 522.
Walford, S. McQ., 395.
Walker, D., 783.
Walker, D. J., 696, 697, 792.
Walker, G. P., 207, 623.
Walker, H. B., 78.
Walker, J., 568.
Walker, J. C., 147, 537.
Walker, J. F., 786.
Walker, J. J., 756.
Walker, L. S., 21, 59, 758.
Walker, M. H., 854.
Walker, W. P., 582, 588.
Walker-Tisdale, C. W., 267.
Wallace, H. A., 285.
Wallace, H. F., 432, 446, 498.
Wallace, J. C., 884.
Wallace, L. W., 285.
Waller, A. G., 781.
Waltman, C. S., 835.
Walton, C. L., 356.
Wang, T. C., 586, 589.
Wann, F. B., 45.
Ward, C. B., 678.
Ward, F. E., 789.
Ward, J. C., 115.
Wardle, R. A., 350, 749.
Ware, F., 267.
Ware, J. O., 536.
Ware, W. M., 537.
Warner, K. F., 257.
Warner, M. F., 520.
Warren, G. M., 882.
Warren, T. J., 598.
Warth, F. J., 258, 558.
Warwick, B. L., 174, 257, 430, 458, 498.
Wasson, R. A., 599.
Watanuki, T., 372, 570, 870.
Watenpaugh, H. N., 398.
Waterman, E. W., 298.
Waterman, H. C., 699.
Waters, N. F., 821.
Watkin, J. E., 32.
Watson, E. A., 174.
Watson, E. B., 15.
Watson, J. R., 356, 739, 855.
Watson, S. A., 356.
Watt, W. L., 220.
Watts, G. S., 285.
Watzek, A. R., 599.
Waycoup, P. L., 855.
Weatherby, L. S., 293, 490.
Weatherwax, P., 825.
Weaver, D. S., 776.
Weaver, F. P., 285.
Weaver, H. J., 599.
Weaver, L. A., 860.
Weaver, W. W., 284.
Webb, B. H., 266, 565.
Webb, J. L., 156.
Webb, O. E., 598.
Webber, H. J., 97.
Weber, F., 425.
Weber, H., 843.
Webster, L. T., 770.
Webster, R. L., 246.
Webster, T. A., 98, 392.
Wedemann, W., 470.
Wedgworth, H. H., 445.
Weeks, D., 80.
Wehmer, C., 720.
Wehnelt, B., 514.
Wehrwein, G. S., 285.
Weidemann, A. G., 113.
Weidling, K., 758.
Weimer, J. L., 447.
Weinberg, M., 71.
Weinstock, M., 295, 596.
Weinzirl, J., 566.
Weiss, H. B., 550, 855.
Welborne, W. W., 433, 446, 498.
Weldin, J. C., 821.
Wellensiek, S. J., 535.
Wellenstein, G., 753.
Wellington, J. W., 699.
Wellman, F. L., 147.
Wells, B. W., 721.
Wells, H. M., 230, 442.
Wells, R. W., 757.
Welter, W. A., 427.
Welton, F. A., 56.
Wentz, J. B., 331.
Wenzel, H., 262.
Werestschiagina, W. J., 672.
Werkman, C. H., 611.
Werner, H. O., 224.
Wertheimer, E., 212.
Westbrook, A., 515.
Westbrook, E. C., 136.
Wester, J., 269.
Westerfield, N. C., 865.
Westergaard, H. M., 775.
Westgate, J. M., 796.
Westveld, R. H., 838.
Wheeler, G. A., 597.
Wheeler, W. M., 51.
Wheeler, W. P., 398.
Wheeting, L. C., 421, 618.
Whelan, D. B., 546.
Whetzel, H. H., 741.
Whipple, G. H., 392, 393.
Whitaker, D. M., 120.
Whitaker, R., 869.
Whitcomb, L. R., 599.
Whitcomb, W., 154.
Whitcomb, W., jr., 554.
Whitcomb, W. D., 454, 660, 849.
White, G. C., 105.
White, G. F., 858.
White, H., 853.
White, H. B., 680.
White, P., 796.
White, R. P., 149, 743.
White, T. H., 622.
White, W., 67.
Whitehead, T., 29.
Whiting, R. A., 661.
Whitnah, C. J., 396.
Whitney, L. F., 820.
Whitson, A. R., 115, 119.
Whittier, E. O., 807.
Wiancko, A. T., 207, 210, 220, 623.
Wiant, J. S., 748.
Wickens, G. W., 653.
Wickens, P. G., 631.
Wiecking, E. H., 79, 883.
Wiegand, E. H., 738.
Wiggans, C. B., 835.
Wiggans, R. G., 220.
Wiggin, W. W., 439, 640, 645.
Wight, A. E., 70.
Wilcox, F. R., 288.
Wilcox, R. H., 684.
Wilder, T. S., 495.
Wildermuth, R., 14, 16.
Wilenski, B. A., 503.
Wilfong, H. S., 175, 770.
Wilinsky, C. F., 381.
Wilkes, E. T., 795.
Willaman, J. J., 720.
Willard, A. C., 577.
Willard, C. J., 436, 640.
Willard, H. H., 806.
Willard, R. E., 181.
Willett, H. C., 111.
Willham, O. S., 59, 66, 166, 464, 487, 559.
Williams, C., 302.
Williams, C. B., 225, 226, 622, 657, 713, 715, 718, 725, 726, 728, 784, 812.
Williams, C. F., 734, 735.
Williams, C. G., 498.
Williams, C. L., 543.
Williams, G. W. M., 312.
Williams, N. F., 70.
Williams, O. E., 369.
Williams, P. N., 390.
Williams, R. C., 444, 709.
Williams, W. J., 229.
Williams, W. K., jr., 798.
Williamson, J. T., 130.
Willits, F. P., 285.
Wills, H. M., 313.
Wilson, A., 246, 848.
Wilson, A. L., 27, 37, 633.
Wilson, B. D., 506.
Wilson, C. S., 302.
Wilson, E. E., 148, 533.
Wilson, F. G., 840, 846.
Wilson, G. F., 357.
Wilson, H. F., 554.
Wilson, H. L., 67.
Wilson, I. D., 70.
Wilson, J. D., 21, 444.
Wilson, J. F., 260, 698.
Wilson, J. W., 96, 848.
Wilson, M. C., 188, 789.
Wilson, R. N., 356.
Wilson, T. M., 830.
Wilson, W. R., 567.

Wimshurst, F. M., 854.
Windsor, M. F., 867.
Winkler, A. J., 336, 644, 836.
Winkler, K., 767.
Winsor, L. M., 75.
Winter, A. R., 663.
Winters, R. Y., 797.
Wise, J. A., 76.
Wishart, G., 256.
Wittmack, L., 800.
Woelkoff, A. D., 522.
Wohlfeil, T., 191.
Wolcott, G. N., 246, 357, 539.
Wolf, F. A., 237.
Wolfanger, L. A., 422.
Wolff, S. E., 536.
Wollenweber, H. W., 532.
Wollner, F., 478.
Wolman, L., 381.
Wood, C. L., 346.
Wood, D. C., 883.
Wood, E. J. F., 844.
Wood, T. A., 881.
Woodbridge, M. E., 441.
Woodnutt, W. E., 267.
Woodroof, J. G., 38, 739.
Woodruff, L. C., 254.
Woods, A. F., 105, 285, 399, 704.
Woodside, J. W., 346.
Woodward, K. W., 142.
Woodworth, C. E., 154.
Woodworth, C. M., 723, 828.
Woodworth, H. C., 180, 283.
Woodworth, R. H., 215.
Woolf, D. O., 878.
Wooten, H. H., 686.
Wormald, H., 347, 658.
Wright, A. H., 127, 128, 149.
Wright, J. K., 283.
Wright, K. E., 466, 566, 867.
Wright, N. C., 888.
Wright, S., 218.
Wright, W. H., 399, 675.
Wulfert, M. A., 887.
Wyche, R. H., 729.
Wyman, E. T., 294, 795.
Wymore, F. H., 852.

Yakimoff, W. L., 374.
Yamane, J., 821.
Yarnell, D. L., 379.
Yarnell, S. H., 721.
Yarsley, V. E., 10.
Yeatman, F. W., 291.
Yee, M., 190.
Yerkes, G. E., 231, 441.
Yetter, W. P., jr., 151.
Yoder, P. A., 400.
Yoder, R. C., 641.
Yothers, M. A., 157, 246, 660.
Young, A. L., 357.
Young, C. H., 391.
Young, D., 284.
Young, E. C., 578.
Young, F. D., 228.
Young, H. C., 150, 444, 709.
Young, H. P., 283.
Young, V. H., 536.
Youngs, F. O., 616.
Yount, H. W., 283.

Zahnley, J. W., 227.
Zaitzev, G. S., 400.
Zappe, M. P., 359, 547.
Zaumeyer, W. J., 147.
Zehner, M. G., 445.
Zeissig, A., 675.
Zeleny, L., 524.
Zeller, J. H., 462.
Zeller, P. J. A., 283, 480, 780.
Zeller, S. M., 244.
Zilva, S. S., 264, 296.
Zimmerley, H. H., 642, 730, 736.
Zimmerman, C. C., 85, 382, 787.
Zimmermann, A., 532.
Zink, F. J., 478.
Zinzalian, G., 456.
Zon, R., 284, 530, 646.
Zwaluwenburg, R. H. Van, 357.
Zwick, W., 876.

INDEX OF SUBJECTS

NOTE.—*The abbreviations* "Ala.," "Conn.State," "Mass.," etc., *after entries refer* to the publications of the respective State experiment stations: "Alaska," "Guam," "Hawaii," "P.R.," and "V.I." to those of the experiment stations in Alaska, Guam, Hawaii, Porto Rico, and Virgin Islands; "Can." to those of the experiment stations in Canada; and "U.S.D.A." to those of this Department.

Abaca, Philippine, bleaching, 394.
Abortion—
  agglutination test for, Idaho, 878.
  avirulent vaccine for, Mich., 878.
  control, 70; Oreg., 68.
  in cattle—
    eradication, Ga., 175.
    immunisation, Mich., 471.
    prevention methods, Mich., 471.
    rapid and slow agglutination tests for, 675.
    relation to nutrition, Wis., 178.
    transmission experiments and importance of trichomonads in, 471.
  in fowls, Mich., 875.
  progress in control, 257.
  report, 70.
  studies, Kans., 172; Mich., 768.
  use of Huddleson's vaccine for, results, 674.
  (*See also Bacillus abortus and Bacterium abortum.*)
Acanthocephala, nomenclature, 350.
Acanthocoris scabrator, life history and habits, 754.
Accessory food factors. (*See* Vitamins.)
Acerastes, new genus, erection, 758.
Acetic acid, formic acid in, determination, 109.
Acetone, production from corn, fermentation methods, Wis., 107.
Achaea lienardi, notes, 550.
Achatodes zeae, notes, Iowa, 854; Mich., 450.
Acid phosphate. (*See* Superphosphate.)
Acidosis of pregnant ewes, Ky., 878.
Acids, amino. (*See* Amino acids.)
Acids, disinfecting power, 870.
Acids, fatty. (*See* Fatty acids.)
Acids in figs, 804.
Acids in maple sirup, 804.
Acids in plant cell membranes, 815.
Acids, organic ionization constants, 708.
Acridotheres tristis, notes, 857.
Acriflavine treatment of undulant fever, 872.
Acrobasis palliolella, control, 553.
Adelges abietis, notes, Mich., 450.
Adoretus sinicus, natural enemies, 753.
Aedes spp., studies, Mont., 158.
Aegeria exitiosa. (*See* Peach borer.)
Aeolothrips fasciatus on apples, notes, Oreg., 53.
Aeration of culture solutions, effect on tobacco plants, 213.
African coast fever, immunity, 69.
Agar, addition to Cheddar cheese, Idaho, 869.
Agar-agar swelling, effect of ultra-violet rays, 120.
Agglutination test in *Brucella abortus*, discrepancies, 567.
Agonocryptus, new genus, erection, 758.
Agrarian policy, German, treatise, 688.
Agricultural—
  aid in Czechoslovakia, 285.
  chemistry. (*See* Chemistry.)
  colleges, organisation list, U.S.D.A., 290.
    (*See also* Alabama, Iowa, Michigan, *etc.*)
  colonization in Palestine, 381.
  contrasts, 285.
  cooperation in Soviet Union, 887.
  credit, Ga., 179.
  credit facilities in New Zealand, 287.
  credit, facts, and problems, Ark., 579.
  credit problems of cotton farmers, Ga., 685.
  credit situation in Minnesota, Minn., 382.
  credit situation in southwestern Arkansas, Ark., 785.
  depression, relation to reclamation projects, 285.
  development in Europe, postwar, Iowa, 394.
  economics research, survey method, 683.
  economics, treatise, 578.
  education—
    and research in Irish Free State, notes, 500.
    in Belgium, status, 691.
    in England, 600.
    in United States, 1785–1925, history, U.S.D.A., 489.

Agricultural—Continued.
education—continued.
in United States, 1785–1925, history, editorial, 401.
vocational, part-time instruction in, 690.
vocational, teacher training, 385.
(*See also* Agricultural colleges, Agricultural instruction, *and* Agricultural school.)
engineering. (*See* Engineering.)
experiment stations. (*See* Experiment stations.)
experimentation in Denmark, organization methods, 898.
exports, trends in, 284.
extension. (*See* Extension.)
income, papers on, 579.
instruction for Ireland, 691.
(*See also* Agricultural education.)
journals, new, 300, 800.
labor and power, studies, Pa., 776.
labor costs, relief from, 285.
labor requirements of crops and livestock, U.S.D.A., 482.
labor, wages, index numbers, Ohio, 181, 482, 684, 883.
(*See also* Labor.)
laborers, hired, perquisites and wages, U.S.D.A., 786.
law in Great Britain, 888.
legislation, international yearbook, 289.
Libraries Section, meeting, editorial, 101.
machinery—
and implements at Pusa, 882.
life, service, and cost, Iowa, 881.
survey of selected districts, Pa., 776.
textbook, 290.
(*See also* Combines *and* Threshing.)
maps, U.S.D.A., 487.
Marketing Act and research, editorial, 301.
outlook for 1929, U.S.D.A., 82.
outlook for 1929, charts relating to, U.S.D.A., 584.
outlook, improving, 283.
outlook of Iowa for 1929, Iowa, 181.
output of Scotland, 289.
policy, guide for Great Britain, 883.
policy, national, basis for, 285.
production—
adjustment to home market demands, Va., 885.
and consumption, changes in, 284.
and consumption in a rural-urban trade area, Ill., 487.
in Germany, effect of the war, 289.
index numbers, Ohio, 181, 482, 684, 883.
problems in Bitter Root Valley, analysis, Mont., 684.
standardization, 285.

Agricultural—Continued.
products—
in industry, 285.
in United States, labor requirements, U.S.D.A., 482.
marketing. (*See* Marketing.)
nonperishable, surpluses, handling, 578.
prices, Ohio, 181.
prices, index numbers, Ohio, 683.
prices, raising by Government action, 285.
purchasing power, trend in, 284.
reform in United States, treatise, 887.
regions of North America, 288.
relief, bibliography, U.S.D.A., 688.
research in Albania, notes, 500.
school and experiment station of Nicaragua, plan for, 400.
situation, aspects, 579.
statistics, U.S.D.A., 487.
statistics for England and Wales, 888.
statistics, international yearbook, 289.
statistics of Nebraska, 289.
statistics of Pennsylvania, 289.
surplus control, 285.
teaching, development in Mississippi, 290.
workers, trio of gatherings in Washington, editorial, 101.
Agriculture—
adjustments in, proposed plan, Ill., 483.
American, future aspects, 258.
and nature in dry regions of Russia, 327.
and technical instruction for Ireland, report, 691.
Department of. (*See* United States Department of Agriculture.)
diversification, limitations and advantages, 285.
electricity in. (*See* Electricity.)
improving in Punjab, prize for, 899.
in Russia, predominating influence of climate, 416.
in Thuringia, effect of climate, 809.
in United States, U.S.D.A., 487.
in United States, balancing, trends, 285.
in Uruguay, 825.
industrialization, 285.
national policies toward, 285.
Agriolimax agrestis, control, Calif., 352.
Agromyzidae, studies, 55.
Agronomy research—
publications of North Carolina, N.C., 726.
results in, N.C., 725.
Agropyrons, chromosome numbers in, 721.
Agrotis. (*See* Cutworms.)
Air, humidified hot, for sterilizing dairy utensils, Calif., 467.
Air permeability of building materials, walls, and types of construction, 679.

Air, physics of, treatise, 204.
Air requirements of poultry, Iowa, 367, 377.
Airplane control of boll weevils, Tex., 556.
Airplane dusting experiments with pecan leaf case-bearer, 553.
Alabama argillacea, migratory habits, 357.
Alabama College, notes, 198.
Alabama Station, notes, 198.
Albino cattle, inheritance studies, Wis., 123.
Alcaligenes melitensis. (*See Brucella melitensis*.)
Alcohol—
effect on growth of seedlings, 514.
industrial, potash from, Md., 821.
(*See also* Butyl *and* Ethyl alcohol.)
Aldehydes, chemical constitution and germicidal activity, 410.
Aleyrodes vaporariorum. (*See* White fly, *greenhouse*.)
Aleyrodidae of Brazil, 755.
Alfalfa—
and rape pasture for pigs, Mich., 459.
breeding experiments, N.J., 724; Utah, 27.
culture, calcium as factor, Wis., 119.
culture experiments, Kans., 125; Va., 726.
cutting tests, Kans., 125; Ohio, 426.
diseases, studies, Kans., 145.
duty of water experiments, Oreg., 27.
effect on clay soil, Oreg., 19.
effect on soil moisture, 519.
feeding value for poultry, S. Dak., 62.
fertilizer experiments, Idaho, 823; Miss., 433, 434; Va., 716, 726, 727.
growth in sand cultures, effect of pH, Kans., 117.
hay and barley, feeding value, Calif., 362.
hay, chopped, effect, Wis., 160.
hay, cost of production, Oreg., 685.
hay, curing experiments, Iowa, 329.
hay, effect of sulfur, Oreg., 20.
hay, feeding value, Wis., 163.
hay, high-grade, production and marketing, U.S.D.A., 129.
hay production, cost and efficiency, Oreg., 582.
hay, stack-browned and green, comparison, Kans., 167.
hay v. soybean hay for milk production, Kans., 167.
hay v. timothy hay for horses, Iowa, 364.
hay, vitamin A in, Ohio, 456.
hay, vitamin D in, Wis., 168.
in western Oregon, Oreg., 633.
insects affecting, 658; Kans., 152.
irrigation experiments, Kans., 126; Utah, 27.
leaves, dried, value for poultry, Idaho, 861.
manuring experiments, Oreg., 26.
pasture for pigs, Mich., 462; U.S.D.A., 761.
Alfalfa—Continued.
pasture, irrigated, returns from, Kans., 162.
pasture v. dry lot for pigs, 257.
pasture v. sweetclover pasture for dairy cows, S.Dak., 66.
production, subsoil moisture in, significance, 518.
proteins, metabolism experiments and biological value, Mich., 68.
residual effect on soil, Kans., 116.
roots and tops, effect on molds in soil, 510.
rotation experiments, U.S.D.A., 724.
seed, production, Utah, 29.
seed yields, factors affecting, Idaho, 823.
seeding experiments, Oreg., 27; Va., 726.
tests, Hawaii, 723.
v. sweetclover, white, for milk production, Kans., 167.
variegated, value, N.J., 725.
variegated, variety tests, Mich., 432.
varietal comparisons, Kans., 126.
varieties, Kans., 125.
variety tests, Idaho, 823; Kans., 125; Mich., 432; N.Dak., 726; N.J., 724; N.Mex., 219; Nebr., 824; Oreg., 26; Tenn., 127; Utah, 27; Va., 726.
weevil, notes, Idaho, 848.
weevil parasite, notes, Ind., 853.
white spot, notes, Utah, 45.
wilt, survey, Nebr., 840.
winter hardiness, studies, Iowa, 329.
winterkilling, Wis., 129.
Algal spores in water, density, N.J., 748.
Alimentary canal of rats, pH of, 388.
Alkali—
reclamation, Calif., 314.
soil reclamation, Calif., 317; Oreg., 18.
soils, studies, Idaho, 810.
Alkaline—
chemicals, effect on sludge digestion, N.J., 480.
soils, dispersion and mechanical analysis, 505.
soils with different exchangeable bases, properties, 506.
washing solutions, germicidal properties, 411.
Allelomorphs, multiple, v. multiple factors, 215.
Allen, Edwin West, editorial, 701.
Allograpta obliqua, notes, 549.
Allygus mixtus, introduction and distribution, 249.
Almonds, characteristics and culture, N.Mex., 141.
Alopecia in a fowl, 821.
Alternaria—
brassicae, notes, Mass., 840.
citri, notes, Calif., 341.
dianthi, notes, Mass., 840.
sp., notes, 244, 245.

Aluminum—
effect on plant growth, 817.
in Chinese foods, 589.
in crops and soils, R.I., 615.
in plant and animal matter, 589.
minute quantities, detection, Mich., 712.
sulfate in spray liquid, effect, Wash. Col., 551.
American—
Association of Medical Milk Commissions, proceedings, 563.
Dairy Science Association, editorial, 105.
Dairy Science Association, proceedings, 262.
Farm Economic Association, meeting, papers and discussions, 578.
Society of Animal Production, proceedings, 257.
Amide and lipoid, relations, 818.
Amines, chemical constitution and germicidal activity, 410.
Amino acids—
biochemistry, 9.
ultra-violet absorption curves, 306.
Ammonia—
in green plant tissues, determination, N.J., 719.
in soil, effects of carbon disulfide treatment, 510.
nitrogen in soil, R.I., 615.
titration, potentiometric, 806.
Ammonium—
molybdate-nitric acid solution, preparation, 108.
salts, effect on reaction of solutions and plant growth, 516.
sulfate as herbicide for mustard, strength, N.H., 127.
sulfate basing, value, Mass., 814.
sulfate, nitrogen availability, factors affecting, N.J., 714.
Amorbia essigana n.sp., description, 853.
Amphicoma vulpina, control, Mass., 850.
Amylase, studies, 11.
Anabrus simplex. (*See* Cricket, Mormon.)
Anaphes pratensis, notes, Ind., 353.
Anaplasma marginale—
longevity in blood of cow, 269.
transmission by ticks, 175.
Anaplasmosis—
in cattle, 269; Kans., 172.
of bovines, transmission by ticks, 175.
Anarhopus sydneyensis n.g. and n.sp., description, 758.
Anasa tristis. (*See* Squash bug.)
Anastrepha striata, notes, 857.
Anas parthenope as intermediate host of *Prosthogonimus putschkowskii*, 574.
Anemia—
blood regeneration in, effect of liver extract, 892.
equine infectious, diagnosis, 272.
in pigs, Ind., 863, 870.
in rats, 660.
Anemia—Continued.
in rats, relation to vitamin E deficiency, 297.
nutritional, blood regeneration in, 590.
nutritional, in albino rats on sole milk diet, 490.
Angitia blackburni, notes, 851.
Anhydremia in vitamin B deficiency of rats, 697.
Animal—
breeding, genetic tests in, Ohio, 498.
(*See also* Hybridization *and specific animals*.)
diseases—
and control in South Africa, 69.
in Bihar and Orissa, 174.
in Burma, 174.
in Canada, 174, 371.
in Ceylon, 371.
in Denmark, 174.
in Madras, 267.
in New South Wales, 870.
in Philippines, 267.
in Punjab, 567.
in Rhodesia, 371.
in United Provinces, India, 267.
post-vaccination trouble, 70.
studies, Kans., 172.
textbook, 567.
(*See also specific diseases*.)
experimentation, number in lot, 258.
fats. (*See* Fats.)
health problems, research in Australia, 371.
husbandry experiment farm at Beltsville, U.S.D.A., 457.
husbandry instruction, papers on, 257.
internal organs, development, effect of quantity of protein in ration, Calif., 360.
metabolism, measuring equipment and technic, N.H., 857.
nutrition research in Australia, 871.
nutrition, studies, Calif., 860; Iowa, 861.
pests, control, patents relating to, U.S.D.A., 548.
reproduction and inheritance, studies, Kans., 123.
tissue, aluminum in, 589.
tissues, amino acids in, 806.
traction in operation of field machines, results, 478.
Animals—
experimental, effect of BCG vaccine, 272.
fertility in, factors affecting, 821.
game, life history and habits, 748.
(*See also* Cattle, Livestock, Mammals, Sheep, *etc*.)
Anisakinae, new larval nematode, 571.
Anomala orientalis—
anatomy and biology, Conn.State, 556.
distribution and abundance in New York, 556.

Anopheles, breeding places, factors affecting, 854.
Anopheles—
culicifacies in Ceylon, 660.
fuliginosus, transmission of surra experiments, 660.
maculipennis development, factors affecting, 753.
(*See also* Malaria *and* Mosquitoes.)
Anthelmintics, studies, Va., 768.
Anthonomus—
grandis. (*See* Boll weevil.)
pomorum hibernation, 354.
signatus. (*See* Strawberry weevil.)
Anthores leuconotus on coffee, 850.
Anthracnoses of plants, new or little known, 647.
(*See also specific host plants.*)
Anthrax—
antigens, sterile, production, Ark., 870.
immunization, 470.
spores, disinfection, 870.
spores on skins of dead animals, effect of formaldehyde vapor, 71.
symptomatic. (*See* Blackleg.)
Antibody and antigen, 870.
Antibody and antigen, heterogeneous, studies, 567.
Anticarsia gemmatilis on peanuts in the Everglades, 550.
Antidesma, eradication, 227.
Antigen and antibody, 870.
Antigen and antibody, heterogeneous, studies, 567.
Antineuritic vitamin. (*See* Vitamin.)
Antirachitic. (*See* Rickets *and* Vitamin D.)
Antiscorbutic. (*See* Scurvy.)
Antiscorbutic vitamin. (*See* Vitamin C.)
Antixerophthalmic vitamin. (*See* Vitamin A.)
Ants—
attacking tobacco, 256.
notes, Utah, 54.
red forest, biology, 753.
relation to aphids, Colo., 557.
two introduced into United States, 256.
white. (*See* Termites.)
Anuraphis roseus. (*See* Apple aphid, rosy.)
Anusoidea comperei n.sp., description, 758.
Apanteles thompsoni, notes, U.S.D.A., 57.
Aphaenogaster barbara on tobacco in Turkey, 256.
Aphanomyces—
camptostylus n.sp., description, 237.
cladogamus n.sp., description, 236.
cochlioides, studies, 236.
euteiches on peas, N.J., 748.
Aphids—
and ant attendants, Colo., 557.
control, relation to bean mosaic, 848.
resistance to toxic sprays, variation in, 549.
woolly, sprays for, Oreg., 53.
(*See also* Apple aphid, woolly.)
Aphis—
brassicae. (*See* Cabbage aphid.)
fabae, transmission experiments with virus diseases, 651.
forbesi. (*See* Strawberry root louse.)
maidis. (*See* Corn leaf aphid.)
persicae. (*See* Peach aphid, green.)
pomi. (*See* Apple aphids.)
pseudobrassicae, notes, Mich., 450.
rhamni, transmission experiments with virus diseases, 651.
rumicis. (*See* Bean aphid.)
spiraecola, biology and control, 548; Fla., 754.
spiraecola, toxic spray for, Md., 856.
Aphodius granarius, intermediate host for *Hymenolepis carioca*, 455.
Apiaries, inspection, Conn.State, 547.
Apiculture. (*See* Beekeeping.)
Aplanobacter insidiosum, notes, Kans., 145.
Aplanobacter michiganense, notes, Utah, 45.
Apogossypol, studies, 10.
Apoplexy, parturient. (*See* Milk fever.)
Apparatus—
atmometer, automatically recording, 819.
continuous can washer for dairy plants, Calif., 282.
fiber-testing machine, Calif., 894.
for burette reading, 805.
for collecting measured areas of sprayed foliage, N.J., 751.
for continuous measurement of respiration in plants, 24.
for determining basic viscosity of ice cream mix, 869.
for electrodialysis, description, 412.
for exposure of ergosterol to ultraviolet light, 92.
for measurement of conductivities of very small volumes of liquids, 203.
for rayon identification, 98.
for rearing flies in laboratory, 848.
for studying effect of constant v. variable temperatures on insect metabolism, 655.
for studying tree root respiration, 524.
for ultrafiltration, 508.
for withdrawal of soil tubes, description, 504.
freezing, for peach bud hardiness study, Mass., 832.
gas washing bottle, description, 412.
jar proof galvanometer mounting, 12.
lysimeter for study of leaching of nitrogen, notes, 798.
seed counter, U.S.D.A., 34.
shaker for Clark hydrogen electrode vessels, 12.
soil sampling tube, 503.
torsion dynamometer, 880.
used in Philippine textile industry, 331.
wash bottle flask, nonspattering semiautomatic, 108.

Apple—
aphid, rosy, control, Oreg., 52.
aphid, woolly—
in Chosen, 549.
notes, Va., 752.
relation to perennial canker, Oreg., 540.
(*See also* Aphids, woolly.)
aphids, notes, Ohio, 450.
aphids, overwintering eggs, combined sprays for, N.J., 452.
bitter pit, origin, 652.
bitter pit, relation to dates of picking, 653.
blotch, cycle of infection, Ind., 342.
brown rot, control, 847.
brown rot, notes, 653.
bud moth, fringe wing, notes, Mich., 450.
canker, perennial, relation to woolly aphid, Oreg., 540.
cuttings, rooting and callusing, 787.
diseases, control with calcium sulfide, Va., 347.
farms, economic study, Me., 183.
fire blight, overwintering and modes of infection, Mich., 448.
fruit bud formation, studies, N.H., 138.
fruit spot, control, N.J., 741.
green mold, notes, 245.
industry in Arkansas, Ark., 782.
industry, McIntosh, Mont., 483.
industry of New England, economic research in, 283.
juice, salt content, estimation, 310.
leafhoppers, notes, Ohio, 450.
maggot, notes, 358; Mich., 450.
maggot, spraying recommendations, Mass., 849.
measles, studies, N.Mex., 236.
nursery stock, crown gall and callus knot on, control, 231.
orchard management, Ohio, 440.
orchards, spraying experiments, N.Mex., 247.
perennial canker, notes, Oreg., 49.
pollen handling for long-distance shipment, 527.
prices by variety, grade, and size, Oreg., 689.
root borer, giant, notes, N.Mex., 247.
rot due to *Hypochnus* sp., notes, 244.
rust diseases, three types, N.Y.Cornell, 150.
sales of an Ohio orchard company, Ohio, 694.
scab, control, 649, 845; Me., 540; N.J., 743; Ohio, 444, 449; Oreg., 49; Wis., 148.
scab, control, failure of sulfur dusts in, Ohio, 150.
scald, shredded oiled paper for, Ind., 387.
seedlings, vigor, effect of pollen parents, 230.
seedlings, vigor in, variability, 231.

Apple—Continued.
spurs, bearing, nitrogen and carbohydrate distribution, Mo., 40.
sucker, control, 856.
target canker, studies, 244.
tissue, abnormal, biochemical differences in, 516.
tree canker, cause, Oreg., 44.
trees, composition, seasonal changes in, Ind., 888.
trees, fertilization, 837; Kans., 137.
trees, growth and yield, effect of height of head, W.Va., 231.
trees, newly set, light v. heavy pruning, Nebr., 833.
trees, soil management, Ind., 337.
trees, winter injury, treatments, Mich., 442.
trees, young, variability, effect of clone roots, 231.
twig growth, studies, N.J., 783.
twigs, 2–3 year portions, distribution of constituents, Minn., 39.
washing machine, description, Oreg., 779.
wood, hardiness, determination, N.H., 139.

Apples—
and crab apples, hybridization, 430.
arsenical residue removed from, N.Mex., 227.
biennial fruiting habit, effect of sodium nitrate, Va., 736.
breeding experiments, 643; Idaho, 831; Iowa, 839; S.Dak., 39.
breeding in Canada, 643.
bud injury from low temperatures, varietal differences, N.J., 733.
calyx injury in, Oreg., 541.
catalase activity, effect of freezing, N.Y.Cornell, 426.
chromosome number in, 24, 517.
consumer demand for, Mass., 690.
cost of production, Ohio, 685.
crab. (*See* Crab apples.)
cross-pollination requirements, Md., 831.
decay in storage, control, Oreg., 50.
defective graft unions in, Mich., 525.
dropping, cause, Ohio, 439.
effect of ethylene gas on, Mich., 424.
fertilizer experiments, Idaho, 831; Mass., 832; Oreg., 36; Va., 735.
fruit setting, studies, Ohio, 439.
fruitfulness in, 526.
harvesting and handling studies, Oreg., 85.
hydrochloric acid treatment, effect, Ind., 338.
insects affecting, 849.
internal breakdown and water core in, Utah, 37.
marketing, Ohio, 481.
marketing in Philadelphia, N.J., 781.
maturity, relation to long storage, 527.
menaced by cedar rust, Mich., 449.

Apples—Continued.
picking maturity tests, Utah, 87.
pollen viability, 527.
pollination studies, 526, 635; Mich., 230; N.H., 139.
pressure tests, results, N.J., 738.
propagation, Md., 831.
propagation experiments by root-cutting method, 231.
pruning, Mass., 832; Mich., 442; N.C., 735; N.H., 139.
refrigeration, in transit, Ill., 836.
ripening, formation of pectins in, Md., 808.
ripening with ethylene gas, Minn., 39.
Rome Beauty, nonbearing, remedies, 232.
soil management experiments, N.H., 138.
spray residue on, relation to rainfall, Mass., 848.
spray residue removal from, 233, 756; Idaho, 830, U.S.D.A., 40; Va., 736.
spray schedules for, W.Va., 442.
spraying experiments, Me., 540.
spraying with oil-nicotine combination, 252.
spreader tests on, Va., 753.
stock and scion, interrelation, Mass., 832.
storage behavior, effect of sodium nitrate, Ohio, 439.
storage studies, Ind., 338; Iowa, 339; N.H., 138.
stored, bull's-eye rot of, notes, Oreg., 541.
table, first commercial congress on, 232.
thinning experiments, N.H., 138.
time of picking tests, Oreg., 36.
time of planting, Md., 831.
use in confections, Oreg., 89.
varieties, N.Y.State, 340.
varieties, resistant to cedar rust, Kans., 146.
varieties, self-fertile and self-sterile, Mass., 833.
variety tests, N.Dak., 735, Ohio, 439; Oreg., 36.
White Calville, pollination experiments, 527.
winter injury, Oreg., 36.
yields, Kans., 138.
Apricot—
black heart, cause, Calif., 842.
Japanese, as rootstock, 229.
kernels, carbohydrate changes in, Calif., 335.
shot-hole, control, 848.
Apricots—
effect of iron sulfate, Calif., 842.
Prunus mume as rootstock for, Calif., 841.
tracheal sap, variations in composition, Calif., 836.
yields, Kans., 138.
Arachnoidism, case of, 863.
Archips argyrospila. (*See* Fruit tree leaf roller.)
Areca palm stem-bleeding disease, control, 842.
Argrilus, revision of genus, 255.
Argyresthia nitidella, notes, 854.
Argyroploce abietana, notes, Mich., 450.
Argyrotaenia velutinana, notes, Va., 752.
Arizona Station, notes, 798.
Arkansas Station, notes, 798.
Arkansas University, notes, 798.
Armillaria mellea, notes, 45.
Armillaria mellea, studies, Calif., 842.
Army worm, Bertha, notes, Mont., 153.
Arsenic, determination, 811, 812.
Arsenical—
injuries and correctives, N.J., 451, 751.
residue on foliage and fruit, relation to growth rate, 544.
residue removal from apples, N.Mex., 227; Va., 736.
residue studies, Oreg., 53.
Arsenicals, use against anopheline larvae, 553.
(*See also* Calcium arsenate *and* Lead arsenate.)
Arsine, determination, 812.
Artesian basins, drainage of land overlying, 477.
Artona catoxantha, relation to *Levuana iridescens*, 753.
Ascaridia—
galli, summary, 375.
lineata in poultry, Kans., 172.
lineata, resistance of chickens to, relation to vitamin D, 474.
perspicillum, notes, 678.
Ascaris larvae migration in host, pathological changes from, 71.
Ascaris lumbricoides tissues, precipitin reactions with, 51.
Ascaris, proteins of, cutaneous tests with, 174.
Ascogaster carpocapsae—
notes, N.Mex., 247.
parasite of codling moth, U.S.D.A., 453.
Ascomycetes spermatia, relation to life history and propagation, Ga., 144.
Aserica castanea, distribution and abundance in New York, 556.
Ash distribution in apple twigs, Minn., 40.
Ash species, root systems, variability, 235.
Ash, Victorian mountain, lignocellulose determination, 803.
Asiatic beetle in Connecticut, Conn.State, 547, 555.
Asparagus—
beetle, toxic spray for, Md., 656.
beetles, control, N.J., 751.
biochemical studies, N.J., 734.
culture, effect of root selection, 523.
cutting and reestablishment of plants, Mass., 833.

Asparagus—Continued.
effect of lengths of green on spears, 523.
fertilizer experiments, Md., 831; N.J., 734.
investigations, Calif., 336.
plants, performance records, 523.
sex in, studies, 523.
treated, vitamin A in, 495.
vitamin A in, 494.
Aspergillus niger and Penicillium mixed inoculum for citrus fruits, effect, 747.
Aspidiotus—
destructor control with Trinidad coccinellids, 659.
perniciosus. (*See* San Jose scale.)
Aster—
Fusarium wilt resistance, development, Wis., 148.
yellows, identity and transmission, Calif., 238.
yellows, prevention, Wis., 147.
Asterochiton vaporariorum, toxic spray for, Md., 656.
Asterocystis radicis, notes, 46.
Asterolecanium coffeae on coffee, 850.
Astilbe forcing experiments with calcium cyanide, 837.
Athericera of Fiji Islands, 55.
Atlas of American Agriculture: Temperature, sunshine, and wind, U.S.D.A., 313.
Atmometer, recording, description, 819.
Atmospheric moisture. (*See* Humidity.)
Atropus sp., notes, Mich., 450.
Australian Dairy Produce Export Board, operation, 285.
Avitaminosis B, nitrogen balance in fowls during, 293.
(*See also* Vitamin deficiency.)
Avocado—
moth, new, description, 858.
pulp preservation, effect of pH, Calif., 387.
Avocados—
acclimatization tests, 529.
side tongue grafting, Hawaii, 732.
starch cycle in, Calif., 336.
vitamin B content, 293.
water consumption under irrigation, Calif., 878.
Azaleas from seed, U.S.D.A., 739.
Azotobacter chroococcum, isolation and identification, use of dextrine in, 316.
Azotobacter—
fixation of nitrogen, cylinder experiments, Kans., 115.
9A, new form, Mass., 810.
vitamin B in, N.J., 710.
Babesiella berbera, transmission by ticks, 175.
Baby beef. (*See* Cattle, baby beef.)
Baccha spp., notes, 549.
Bacillus abortus—
and *Micrococcus melitensis*, differentiation by chemical substances, 71.
from swine, 272.
Bacillus abortus—Continued.
human infection by, 268.
in relation to undulant fever, Ind., 371.
infections, tardy development, 269.
(*See also Bacterium abortum and* Abortion.)
Bacillus—
aertrycke, rôle in canine typhus, 273.
beriberi n.sp., notes, 896.
botulinus, notes, Utah, 59.
bronchisepticus, notes, 675.
danicus, concentrated emulsions, lysis by bacteriophage, 514.
enteritidis. (*See Salmonella enteritidis*.)
leptinotarsae n.sp., proposed name, 358.
melitensis. (*See Micrococcus melitensis*.)
necrophorus. *See* Necrobacillosis.
oedematiens and blackleg, 71.
oedematiens, notes, 373.
prodigiosus as indicator of efficient pasteurization of milk, 867.
subtilis, effect on cheese curd, 266.
suipestifer, cause of fatal human infection, 372.
tuberculosis types, pathogenicity, 870.
Bacon, improvement of quality, 560.
Bacon production in Sweden, 261.
Bacteria—
agglutination rate, effect of temperature, 469.
colonies on petri plates, variation in, cause, 265.
emulsions, highly concentrated, lysis by bacteriophage, 514.
in milk, soil, etc. (*See* Milk, Soil, *etc.*)
microphotographic atlas, 720.
morphology and the d'Herelle phenomenon, 720.
nitrifying, isolation and study, Idaho, 810.
Bacterial spores, studies, 214.
Bactericides, composition, Conn.State, 355.
Bacteriologic culture media. (*See* Culture media.)
Bacteriophage—
active against avian typhoid, N.C., 770.
Kuhn, studies, 720.
lysis of highly concentrated bacteria emulsions, 514.
of d'Herelle, 819.
Bacterium abortum—
isolation, methods, 674.
live cultures fed to cows, effect, Ind., 370.
notes, Mich., 468.
(*See also Bacillus abortus and* Abortion.)
Bacterium—
andropogoni, notes, 48.
campestre armoraciae n.var., description, 240.

Bacterium—Continued.
citriputeale, notes, Calif., 841.
lepisepticum, notes, 770.
malvacearum in cottonseed, control, 844.
melitensis. (See *Micrococcus melitensis*.)
pullorum from European bullfinch, 676.
pullorum, studies, Calif., 370.
pullorum transmission, methods, R.I., 676.
(*See also Salmonella pullorum*.)
pyogenes, biology, 470.
sanguinarium, viability relation to soil reaction, N.J., 769.
solanacearum, notes, 648.
tularense in wood tick, 856.
Bactrocera cucurbitae, notes, 858.
Bakery products, pH determination, 807.
Bakewell, Robert, memorial to, 400.
Balclutha punctata, introduction and distribution, 249.
Balsam bark beetle, notes, Mich., 450.
Balsam fir, volume table, Mich., 43.
Banana—
disease, notes, 648.
diseases in British Guiana, 654.
Bananas—
acclimatization tests, 529.
effect of ethylene gas on, Mich., 424.
respiration during ripening, effect of ethylene, 517.
ripening, formation of pectins in, Md., 803.
ripening with ethylene gas, Minn., 39.
Barathra configurata, notes, Mont., 158.
Bark beetles—
revision, 359, 661.
Swedish, biology, 557.
Barley—
ash content, factors affecting, Utah, 409.
barbless, notes, Wis., 127.
breeding experiments, 29, 825; Kans., 125; Oreg., 26.
cane molasses, and pineapple bran, comparative feeding value, 666.
culture and varieties, Wyo., 487.
culture experiments, Nebr., 824.
dry land culture, U.S.D.A., 724.
fertilizers, effect on following hay crop, 330.
glutelins, 801.
harvest period, Iowa, 329.
inheritance and linkage in, analysis, 629.
inheritance in, correlated, 721.
malting, valuation, 220.
marketing in England and Wales, 384.
new smooth-awned, for irrigated conditions, Colo., 520.
protein and vitamin deficiencies for pigs, Oreg., 61.
ready for combine, moisture in, Miss., 435.
Barley—Continued.
rust resistant varieties, testing, Ind., 342.
scab, control, Mich., 842.
scab, epidemic, Wis., 149.
seed, dehulling with sulfuric acid to induce smut infection, 238.
seeding experiments, Miss., 436.
smooth-awned, tests, Iowa, 329.
smut, covered, infection experiments, Calif., 344.
smut infection, effect of dehulling with sulfuric acid, 238.
status in Michigan, Mich., 330.
stripe, prevention, Wis., 149.
stripe, seed treatment for, Iowa, 843.
varietal comparisons, Kans., 126.
varietal-date of seeding test, Calif., 328.
varieties, 220.
variety tests, Ind., 329; Mich., 432; N.C., 725; N.Dak., 726; N.Mex., 219; Nebr., 824; Oreg., 26; Pa., 436; Utah, 27; West.Wash., 29.
winter hardiness, N.C., 725.
Barn, masonary arch, experiments, Iowa, 377.
Barns, dairy—
floor temperature in winter, Kans., 178.
from manufacturing point of view, 680.
Bartonella muris ratti, studies, 660.
Bean—
anthracnose and heredity, 843.
anthracnose, control, Tenn., 146.
anthracnose, preheating seed for control, N.H., 149.
aphid, parthenogenetic and sexual forms, 549.
bacterial blight, varietal resistance, Miss., 446.
beetle, Mexican—
control, N.J., 255.
economic status, 849.
life history, habits, and control, Va.Truck, 757.
summary, S. C., 662.
toxic spray for, Md., 656.
blight resistant strains, Miss., 446.
flower capsid, notes, 659.
mosaic, a collection of diseases, Mich., 443.
mosaic, relation to insects, 843.
mosaic, studies, Idaho, 839.
mosaic tissue, intracellular bodies in, 843.
stem and root, buffers of, 211.
thrips on pears, 249.
Beans—
and corn, interplanting, Miss., 433.
breeding experiments, Hawaii, 723.
bush type wax, notes, Wis., 137.
cull, feeding value, Mich., 459.
culture experiments, U.S.D.A., 724.

Beans—Continued.
fertilizer experiments, Miss., 438.
germination and early growth, effect of phosphate, Mich., 418.
Hopi Lima, studies, Calif., 328.
inorganic injuries to, 515.
Lima, spot disease, cause, Mich., 443.
paper mulch experiments, 228; Mich., 37; Ohio, 440.
red kidney, variety tests, Mich., 432.
seed treatment, value, Idaho, 839.
spray schedule for, 753.
variety tests, Miss., 438; N.Mex., 219; U.S.D.A., 724.
vitamin C in during germination, 295.
yellow string, aluminum in, detection, Mich., 712.
yields under ultra-violet glass, 834.
(See also Soybeans, Velvetbeans, etc.)
Bears, tapeworms in, anthelmintic for, 273.
Beef—
antineuritic value, 390.
carcass, market desirability, method of expressing, 759.
production on the farm, U.S.D.A., 759.
vitamin B in, 390.
(See also Cattle, beef.)
Beekeepers' Association of Province of Ontario, report, 455.
Beekeeping activities, Can., 455.
Bees—
appendages, variation and correlation in, N.Y.Cornell, 157.
breeding, treatise, 557.
diseases in California, 256.
diseases in German Switzerland, campaign against, 455.
diseases in Switzerland and Germany, 758.
feeding, 360.
foulbrood. (See Foulbrood.)
studies, Kans., 156; N.J., 752.
(See also Honey.)
Beet—
crown gall, 585.
diseases and protection, 841.
leaf miner, notes, Ohio, 450.
leafhopper—
as factor in production of nicotine for insecticides, 250.
control, N.Mex., 247.
morphology, Utah, 851.
notes, Idaho, 848.
outbreaks, predicting, 249.
studies, Utah, 54.
thermohyetics of, 52.
yeast forms from, 250.
leafhoppers and parasites, range in Mexico, Calif., 352.
leafhoppers, Rickettsia-like microorganism in, Calif., 352.
mosaic and spinach mosaic, reciprocal transmissibility, 45.
mosaic tissue, intracellular bodies in, 848.
nematode, control, 542.
Beet—Continued.
seed investigations, methods in, 828.
tops, aluminum in, detection, Mich., 712.
Beetle larvae, Indian, descriptions, 850.
Beetles, buprestid, revision of North American species, 255.
Beetles, long-horned timber-boring, control, 358.
Beets—
fertilizer experiments, R.I., 640.
field or fodder. (See Mangels.)
paper mulch experiments, 228; Mich., 37; Ohio, 440.
preparation for market, U.S.D.A., 834.
selection work, Mass., 833.
sugar. (See Sugar beets.)
Bembecia marginata, studies, N.J., 758.
Bembidion quadrimaculatum, notes, Mich., 359.
Bent-leg in sheep, 69.
Bentonite as dust carrier for nicotine, 249.
Beriberi, etiology, 896.
Berries. (See Fruits, small, and Raspberries, Strawberries, etc.)
Betel disease in Bengal, 842.
Betulaceae, cytological studies, 215.
Bibliography of—
agricultural relief, U.S.D.A., 688.
ants, red forest, 753.
ants, relation to aphids, Colo., 557.
aphids, relation to ants, Colo., 557.
Aphis spiraecola, Fla., 755.
apple aphid, woolly, 549.
bacillary white diarrhea, 874.
bark beetles, revision, 662.
bean anthracnose and heredity, 848.
bird malaria, 274.
Bureau of Biological Survey, 542.
cabbage butterfly, 357.
calcium deficiency as cause of disease, 372.
calcium deficiency in diet of horses, effects, 572.
clothes moth, control, 853.
Coccidia, parasitic specificity, 375.
coccidiosis in rabbits, 678.
Coleoptera molts, 758.
dragonflies of North America, 548.
electricity effect on plants, 427.
enteritis, infectious, in swine, 73.
entomology, agricultural, 848.
entomology problems, 749.
foot-and-mouth disease virus types, 268.
forest entomology, 355.
fowl-pox transmission by mosquitoes, 274.
fruit fly, Mediterranean, 659.
fruits, dried, insects affecting, 850.
fungi, comparative morphology, 518.
fungi, structure and development, 518.
Gracilaria syringella, 550.
grasshoppers and locusts, 55.
Heterakis papillosa, 574.
hog cholera virus, properties, 675.

Bibliography of—Continued.
- insects and pests in Denmark, 548.
- iodine, 590.
- locusts and grasshoppers, 55.
- *Lyctus* powder-post beetles, 655.
- malaria of birds, 274.
- meal worms, life history and habits, U.S.D.A., 458.
- milk, evaporated unsweetened, for infants, 589.
- milk for infant feeding, 790.
- milk powder for infants, 588.
- parasites of sheep, 374.
- peaches, fertilization, Ark., 836.
- phenology of crop pests, 52.
- *Pieris brassicae*, 357.
- plant growth, effects of electricity, 427.
- plants and soils, interrelation, 505.
- pleuropneumonia virus, 675.
- plum curculio on apple, Conn.State, 860.
- poisonous plants, N.Mex., 373.
- proteins, 389.
- red mite, European, biology, U.S.D.A., 157.
- respiratory quotient, 592.
- Rickettsia diseases in Tropics and filtrable virus, 269.
- Rocky Mountain spotted fever, 656.
- sexuality in fungi, 818.
- silkworm diseases, 56.
- soil moisture regulation, U.S.D.A., 77.
- soils and plants, interrelation, 505.
- spotted fever, Rocky Mountain, 372.
- sugarcane borers, 256, 550.
- surra transmission experiments, 660.
- sweetpotato diseases, U.S.D.A., 447.
- tropisms and sense organs of Lepidoptera, 660.
- *Trypanosoma equiperdum* in cats, changes in blood in, 269.
- tularemia, 269.
- vitamin B, 694.
- vitamin D relation to parasites in chicks, 475.
- vitamins, excess of, toxic action, 896.
- walking diseases of horses, Nebr., 769.
- wheat yield forecasting, 689.
- willow scab, Conn.State, 849.
- wood decomposition, 720.
- wood gluing, U.S.D.A., 878.

Binder and knotter troubles, 881.
Binder head and knotter head troubles, 683.
Bindweed, control, 227.
Biochemistry, fundamental laws, 625.
Biocolloids, swelling, 120.
Biology and refrigeration, 528
Birch, hybridization studies, 215.
Birch leaf miner, synonymy, 661.
Bird grass, notes, Calif., 328.
Bird houses from gourds, U.S.D.A., 449.
Bird malaria, studies, 274, 275.
Birds—
- affecting tobacco, 548.
- of Alabama, 655.

Birds—Continued.
- of Alaska, laws and regulations, U.S.D.A., 542.
- of prey, European, treatise, 51.
- relation of preen gland to rickets, 864.

Blackberries—
- breeding experiments, N.J., 784.
- production, Mo., 836.
- pruned, yields, Tenn., 140.
- variety tests, Ga., 136.

Blackberry—
- dwarf disease, description, 244.
- orange rust, notes, Mich., 449.

Blackhead—
- control, N.J., 769.
- in turkeys, epidemiological studies, Conn.Storrs, 475.
- in turkeys, notes, R.I., 676.

Blackleg—
- and *Bacillus oedematiens*, 71.
- studies, Kans., 172.

Blennocampa pygmaea. (See Grape sawfly.)
Blissus leucopterus. (See Chinch bug.)
Blood—
- analysis, precipitant for proteins, 807.
- changes in cats infected with *Trypanosoma equiperdum*, 269.
- composition, effect of an exclusive meat diet, 589.
- dried. (See Blood meal.)
- formation of albino rat, 792.
- formation of young pigs, effect of ultra-violet light, 861.
- groups, human, genetics, 630.
- groups in domestic animals, 873.
- meal, nitrogen availability, factors affecting, N.J., 714.
- meal, nutritive value for growth, Ohio, 663.
- nitrogen determination in, method, 503.
- phosphates and calcium in milk fever, 570.
- regeneration in nutritional anemia, 590.
- regeneration in severe anemia, 392, 393.
- sugar, capillary, fluctuations in young men, 893.

Blowfly, black, parasitism in man, 757.
Blueberries—
- cutworm damage in Maine, 254.
- interplanted with strawberries, Mass., 832.
- mulching system, Miss., 439.
- propagation by cuttings, Oreg., 85.
- respiration rate during ripening, 836.

Blueberry—
- cuttings, rooting, 284.
- plants, types for propagation, Miss., 438.
- stem borer, life history and habits, 662.

Bluegrass—
bulbous, germination of bulbils, Calif., 327.
Kentucky, effect of white clover, Conn. Storrs, 432.
Kentucky, liming, value, Md., 823.
pastures, effect of heavy and premature grazing, Wis., 128.
Bluestem grass, utilization by aged steer, 257.
Bog, shrub, vegetation in, N.C., 721.
Bog soil, microbiological activities in, 508.
Boll weevil—
control, U.S.D.A., 156, 360.
control by airplane dusting, Tex., 556.
hibernated, resumption of egg laying, 556.
longevity, Florida records, 856.
natural enemies, 856.
Bollworm—
as cotton pest, U.S.D.A., 756.
pink, control, 253, 658.
pink, in Punjab, studies, 253.
pink, in Tucumán, 661.
Bombyx mori. (*See* Silkworm.)
Bone, ground, analyses, N.J., 21.
Books on—
agrarian policy, German, 688.
agricultural economics, 578.
agricultural reform in United States, 687.
air, physics of, treatise, 204.
bees, breeding, 557.
bees, breeding, 557.
birds of prey, 51.
botany, 512.
cheese making, 267.
dogs, diet for, 261.
dragonflies of North America, 548.
drainage and reclamation, 275.
economic history, American, introduction, 489.
entomology, agricultural, 848.
entomology, forest, principles, 355.
farm machinery, 290.
farm wiring, 881.
ferns, 530.
field crop enterprises, southern, 290.
food, nutrition, and health, 87.
foods, analysis, 609.
forest fire prevention, U.S.D.A., 86.
fruits and vegetables, marketing, 584.
fungi, comparative morphology, 513.
gardening in southeastern United States, 522.
goats, 859.
grasshoppers and locusts, 54.
helminthology, 372.
homemaking, 691.
horses, stabling, feeding, and care, 666.
horticulture, 227, 290.
insects, 848.
insects and men, foibles of, 51.
laboratory technic, 609.
land economics, 285.
lilies, 530.
Books on—Continued.
locusts and grasshoppers, 54.
mammals, North American, 542.
materials, strength of, 691.
meat through the microscope, 664.
men and insects, foibles of, 51.
narcissus culture, 529.
nature in farming, 489.
parasitology, 567.
physics of the air, 204.
plant diseases, 532.
plant pathology and therapy, 532.
plant protection, 343.
plant world, evolution of substances in, 625.
plants, American, for American gardens, 530.
plants starting under glass, 522.
poultry breeding and production, 560.
poultry raising, 667, 865.
rayon, 96.
rural sociology, 385.
sheep breeding, feeding, and management, 859.
soil science, 503.
urbanization, 385.
vegetables and fruits, marketing, 584.
winter construction methods, 478.
zoology, 350, 847.
Borate mixtures, pH determination, 309.
Bordeaux mixture—
commercial, adhesive quality, Oreg., 35.
direct insecticidal action, 548.
in blight control, value, 526.
making with calcium hydrate, 648.
Bordeaux spraying of cranberries on sanded bogs, injury from, N.J., 747.
Boric acid effect on oxidation of glucose by alkaline copper solutions, 415.
Boron—
deficiency, effect on growth of tobacco plants, 213.
effect on composition and growth of *tomatoes*, 524.
effect on plant growth, 817.
effect on soybean growth, N.J., 719.
effect on tobacco, 719.
requirements of plants, 23.
toxicity, Calif., 317.
Botanical Congress, International, notes, 100.
Botany textbook, 512.
Botrytis—
cinerea and Penicillium mixed inoculum for citrus fruits, effect, 748.
cinerea, notes, 245.
paeoniae, description, revision, 51.
tulipae, control, N.J., 743.
Botulinus toxins, formolized, antigenic value, 871.
Botulism—
among horses, Utah, 69.
outbreaks due to home-canned products, 889.

Boxelder root systems on black soils of Kuban, 235.
Boxes, butter and cheese, comparative serviceability, 279.
Boyce Thompson Institute for Plant Research, southwest arboretum of, 99.
Boys' strawberry club, manual, Ill., 480.
Brachycera of Fiji Islands, 55.
Brachyspasta, new genus, erection, 358.
Bradley Lane experimental road, U.S.D.A., 78.
Bread—
 baked with large amounts of yeast, vitamin B in, 293.
 making, principles, Colo., 291.
 (*See also* Flour.)
Breadfruit trees, propagation, Hawaii, 732.
Breakfast, rôle of chemistry in preparation of food and equipment, 291.
Breeding. (*See* Animal breeding, Plant breeding, *and specific animals and plants.*)
Bremia lactucae, notes, Mass., 840.
Brevicoryne brassicae. (*See* Cabbage aphid.)
Brick wall construction, air infiltration through, 280.
British Goat Society yearbook, 859.
Bronchitis, infectious, of fowls, studies, Calif., 370.
Brooders, electric, tests, Oreg., 75.
Broomcorn—
 bacterial disease, notes, 48.
 variety tests, N.Mex., 219.
Brown creepers, nuthatches, and woodpeckers of New Jersey, N.J., 655.
Browse forage as summer range for cattle, utilization, U.S.D.A., 558.
Brucella abortus—
 agglutinins in human serum, significance, 673.
 from bovines, differences in agglutinability, 567.
 human infection with, 674.
 immunity, persistence, Calif., 369.
 in milk and butter, 471.
 in milk, relation to undulant fever, 674, 872.
 infection in equines, 472.
 infection in fowls, Mich., 875.
 pathogenicity for man and monkey, 372.
 porcine strain, as cause of undulant fever, 268.
Brucella genus, para strains from, 673.
Brucella melitensis—
 and *B. abortus*, differentiation, 269.
 infection in man, 268.
 paramelitensis, notes, 268.
Brucella species, differentiation, 674.
Brunchorstia destruens on pine and in pure culture, 51.
Bryopsis plumosa, protoplasm and chloroplasts in, 626.
Buckwheat middlings, feeding value, 257; W.Va., 163.
Bud moth, eye-spotted, summary, N.Y.State, 155.
Buds and grafts, new wrapping material for, 229.
Buffalo treehopper in France, biology, 250.
Building materials—
 air permeability, 679.
 fire resistant construction, 282.
Bulb flies, greater and lesser, control, 255.
Bulb fly, lesser, notes, Wis., 154.
Bulbs, spring-flowering, culture, Okla.Panhandle, 837.
Bullfinch, European, *Bacterium pullorum* from, 676.
Bulls. (*See* Sires.)
Bunostomum trigonocephalum, notes, Oreg., 768.
Bunt. (*See* Wheat smut, stinking.)
Bureau of Biological Survey, directory of field activities, U.S.D.A., 748.
Bureau of Biological Survey, history, activities, and organization, 542.
Burette-reading device, description, 805.
Burgundy mixture for spraying, studies, N.H., 151.
Butter—
 adulteration with animal fat, detection, 503.
 and cheese boxes, reinforced and unreinforced, strength, 279.
 bacteria in, distribution and growth, 265.
 composition and body, N.Y.Cornell, 868.
 effect of feeding turnips, Oreg., 67.
 fluorescence, measurement, 292.
 price trends in New York City, Mich., 288.
 prices, effects of cold storage, Mich., 288.
 vitamin D in, standardization, 297.
 vitamin D in, variations, 695.
Butterfat—
 determinations, effect of lecithin in dairy products, 204.
 in ice cream, determination, Wis., 171.
 loss in skim milk, Okla.Panhandle, 170.
 marketing in Missouri, Mo., 887.
 percentage of milk, determination, Kans., 167.
 production, mode of inheritance, Mo., 169.
Butterflies of New Zealand, 755.
Buttermilk—
 dried, and meat scraps, value for chicks, Ind., 365.
 drying, Wis., 181.
 factory tests, Idaho, 808.
 powdered, for coccidiosis, Mich., 763.
 semisolid, feeding value, Idaho, 865.
 wheying-off properties, effect of viscolization, N.J., 767.
Butyl alcohol, production from corn, fermentation methods, Wis., 107.
Butyric acid—
 bacteria, action, Wis., 107.
 studies, Wis., 107.

Cabbage—
aphid, control, N.Mex., 247.
aphid, false, notes, Mich., 450.
aphid, toxic spray for, Md., 656.
black rot, notes, Wis., 147.
breeding experiments, Tenn., 140.
butterfly, biological and histological studies, 357.
Chinese, Cercosporella leaf spot of, 240.
Chinese, leaf spot affecting, Mass., 840.
Chinese, vitamin C in, 595.
clubroot, control, Wis., 147.
cost of production data, N.J., 781.
effect of manganese, Ind., 338.
effect of nitrates, Nebr., 833.
effect of shade, N.Mex., 228.
fertility maintenance for, Md., 622.
fertilizer experiments, N.H., 139; N.Mex., 228; R.I., 640.
maggot, control, 544; Wis., 154.
maggot, notes, Ohio, 450.
paper mulch experiments, 228; Ohio, 440.
soup and puree, source of vitamin C for infant feeding, 193.
spray schedule for, 753.
storage experiments, Idaho, 830.
variety, notes, Ohio, 440.
variety tests, N.Dak., 735.
white butterfly control, 354.
yellows resistance, inheritance, Wis., 147.
yellows resistant strain, Iowa, 343; Miss., 446.
Cacao—
beans, molding, effect of sea water, 847.
black pod outbreak, relation to diseased cushions, 847.
pod diseases, dissemination by invertebrates, 847.
research, 528.
Caconema radicicola, studies, Calif., 349.
Cactus, feeding value during drought, 59.
Cajanus indicus, breeding experiments, 29.
Calavos, value in diet, 490.
Calcium—
and magnesium in soil, effect of moisture and cropping, 511.
and magnesium, separating, method, 711.
and phosphorus in bone formation in pigs, Ohio, 456.
and phosphorus ratio in growth of chicks, Ohio, 456.
arsenate for boll weevil control, Ala., 453.
as factor in alfalfa culture, Wis., 119.
balance of milking cows, 257.
carbonate, value in cattle rations, 257.
chlorate as substitute for sodium chlorate, 227.
citrate in nutrition of cows, value, N.J., 764.
citrate, value for poultry, N.J., 764.
Calcium—Continued.
cyanide, forcing experiments with, 837.
cyanide fumigation for bulb fly control, 255.
cyanide fumigation for house fly, S.C., 452.
deficiency as cause of disease, 372.
deficiency in diet of horses, effect, 571.
in blood during milk fever, 570.
in Chinese foods, 589.
in diet, calculation, U.S.D.A., 191.
in zeolitic soils, Ariz., 618.
increase from excessive doses of irradiated ergosterol, source, 295.
metabolism in artificially fed infants, 496.
metabolism in rats, 798.
oxalate precipitation, 414.
salts, demonstration with gelatin oleate mixtures, 711.
salts effect on properties of ice cream mix, 565.
source for poultry, Idaho, 861.
sulfate. (*See* Gypsum.)
sulfide experiments in orchards, Va., 347.
(*See also* Lime.)
Calendra—
granaria. (*See* Granary weevil.)
maidis, studies, S.C., 453.
spp., notes, Ohio, 450.
California—
Station, notes, 97, 299, 395, 598, 700.
Station, report, 394.
University, notes, 97, 299, 395, 598.
Calla lily root rot, notes, 46.
Callicratides rama, notes, 659.
Calliphora erythrocephala development, factors affecting, 753.
Calliptamus italicus, studies, 55.
Callipterus juglandis in America, 246.
Callipterus juglandis in Oregon, 851.
"Calmette" method of vaccination, 70.
Calves—
beef, feeding experiments, Nebr., 858.
beef, wintering, linseed meal v. cottonseed meal, Okla.Panhandle, 559.
dairy, care and management, Wis., 368.
dairy, raising, W.Va., 67.
fattening, Mich., 858; Ohio, 858.
feeding, Ohio, 466.
feeding experiments, Idaho, 865; Kans., 159, 167; Ohio, 169.
feeding experiments in India, 258.
finishing, cane molasses for, Iowa, 759.
growth, effect of sunlight, S.Dak., 66.
growth, studies, Nebr., 866.
metabolism tests, Iowa, 361.
roughages for, 558.
self-feeders for, S.Dak., 561.
substitute for liquid skim milk for, Mass., 866.
tolerance of formaldehyde, Ohio, 466.

Calves—*Continued.*
vaccination against tuberculosis, Calif., 869.
weight variation, factors affecting, U.S.D.A., 671.
Canal Zone Plant Introduction Gardens, report, 529.
Cane-molasses, barley, and pineapple bran, comparative feeding value, 666.
Canna, edible, experiments, Hawaii, 723.
Canning—
crop diseases, studies, Utah, 44.
factories, tomato, organization and management, Ark., 886.
industry, position and scope, Md., 384.
nonacid foods, danger of botulism, 889.
Canoeing, energy consumption during, 191.
Cantaloupe. (*See* Muskmelon.)
Capillaria in chickens, 677.
Capitophorus tetrarhodus, notes, 244.
Capnodium sp., biological and cultural characters, 535.
Caprina, studies, 571.
Capsid bug, control, 356.
Capsid bug, green, studies, 850.
Carbohydrate—
diets, high, muscular efficiency on, 693.
metabolism, effect of vitamin deficiencies, 697.
Carbohydrates—
assimilation, relation to potassium in tomato plants, 339.
distribution in apple twigs, Minn., 39.
distribution in bearing apple spurs, Mo., 40.
progressive seasonal changes in plants, Mich., 424.
Carbon—
atom, valency of, tetrahedron concept, 801.
black, structure, 801.
determination, 806.
dioxide determination, 806.
dioxide fertilization, 426.
dioxide penetration into living protoplasm, 513.
dioxide production in fermentation of sauerkraut, 712.
disulfide action on plants, 213.
disulfide emulsion for nematode control, 542.
disulfide for weed eradication, Colo., 732.
disulfide, maximum weights in inclosed space, 545.
disulfide treatment of soil, effects on soil bacteria and ammonia and nitrate content, 510.
monoxide action on autooxidation of sulphydryl compounds, 307.
monoxide reactions with compounds of metals with cysteine, 502.
Carbonates, determination in soil, 413.
Carnation blight, notes, Mass., 840.
Carnations, calyx splitting, relation to nutrition, N.J., 784.
Carotin—
in pig's liver, tests for, 491.
physiological action, 794.
source of vitamin A, 793, 794.
Carphoborus cholodkovskyi, studies, 557.
Carpocapsa pomonella. (*See* Codling moth.)
Carrion's disease, insect vectors, 854.
Carrot rust fly—
biology and control, Mass., 849.
control, 544.
in New York, 554.
Carrot seed, poor germination, cause, Calif., 335.
Carrots—
change in ash content during storage and cooking, Kans., 190.
feeding value for poultry, Calif., 364.
fertilizer experiments, N.H., 139; N.J., 734.
paper mulch experiments, Mich., 37; Ohio, 440.
preparation for market, U.S.D.A., 834.
selection work, Mass., 833.
storage experiments, Idaho, 830.
varieties, Ohio, 441.
variety tests, Oreg., 26.
yields under ultra-violet glass, 834.
Cartodere argus, notes, Mich., 450.
Cartodere spp., notes, 753.
Caryomyia spp., notes, 546.
Casein precipitation at its isoelectric point 410.
Caseinogen-lecithin complexes, studies, 306.
Catalase activity of apples, effect of freezing, N.Y.Cornell, 426.
Catalpa mealybug, notes, Va., 752.
Catch crops, tests, Utah, 27.
Cathode and ultra-violet rays for inducing antirachitic activity in ergosterol, comparison, 495.
Cats infected with *Trypanosoma equiperdum*, blood changes in, 269.
Cat-tail borer, notes, Mich., 450.
Cattle—
acid-fast skin infections, relation to bovine tuberculosis, 70, 270.
albino, inheritance studies, Wis., 123.
and carcasses, grading, 257.
Ayrshire, progeny performance, Mo., 169.
baby beef, from crossbred Angus-Holstein calves, Wis., 161.
beef, dehorning, castrating, and branding, U.S.D.A., 759.
beef, experiments, Ga., 158; Oreg., 59.
beef, experiments at Beltsville farm, summary, U.S.D.A., 457.
beef, feeding experiments, Calif., 362; Kans., 158; Wis., 160.
(*See also* Calves, Cows, *and* Steers.)
beef, feed-lot and ranch equipment, U.S.D.A., 779.

Cattle—Continued.
beef, pasture studies, Utah, 59.
beef, prices, Ohio, 181.
breeding in Alaska, history, Alaska, 158.
browse range utilization for, U.S.D.A., 558.
business, western, development and financing, Colo., 785.
dairy—
breeding experiments, U.S.D.A., 671.
effect of fluorine in ration, Mich., 65.
feeding experiments, Kans., 166; Mich., 464; Ohio, 465; S.Dak., 66.
flies and fly sprays relation to milk production, Calif., 367.
fly repellents for, Kans., 168.
grinding feeds for, Ind., 368.
minerals for, Iowa, 368.
pasturing studies, Kans., 168.
reacting to tuberculin test, skin lesions in, Utah, 69.
tropical, 263.
(*See also* Cows.)
feeding experiments, Ind., 664.
feeding, returns per acre in, Ohio, 665.
(*See also* Cattle, beef, Cattle, dairy, Calves, Cows, *and* Steers.)
forestomachs of, physiology and pathology, 269.
grass-fat, effect of feed on meat, Kans., 160.
grubs, summary, Ohio, 55; U.S.D.A., 757.
Guernsey, weight relation to fat production, 562.
Holstein and Jersey, cross breeding experiments, S.Dak., 25.
industry of Sand Hills, economic aspects, Nebr., 182.
nutritional disorders, Mich., 768.
pasture values and pasture methods, Kans., 158.
plague. (*See* Rinderpest.)
poisoning. (*See* Livestock poisoning, Plants, poisonous, *and specific plants*.)
population of United States, age and sex composition, 257.
purebred Hereford, prices, 1883–1928, Okla.Panhandle, 487.
purebred, starting a herd, Okla.Panhandle, 67.
range, phosphorus deficiency in forage, 58.
range, production, 257.
range, supplemental feed, digestibility, N.Mex., 258.
skin lesions, tubercular, studies, 873.
tick, tularemia infection in, 856.
(*See also* Ticks.)
tricolored condition in, 820.
Cattle—Continued.
tuberculin-reacting, no-lesion, examination, Wis., 173.
weedy grasses injurious to, Iowa, 873.
(*See also* Calves, Cows, Heifers, Livestock, *and* Steers.)
Cauliflower—
fertilizer experiments, N.J., 734.
paper mulch experiments, Ohio, 440.
premature heading, cause, N.J., 734.
storage experiments, Idaho, 830.
variety tests, N.Dak., 735.
yields under ultra-violet glass, 834.
Cecid pest, new, notes, 354.
Cedar—
poles, green-cut and fire-killed, relative strength, 278.
poles, green-cut western, tests, 278.
rust, menace to State orchards, Mich., 449.
rust resistance of apple varieties, Kans., 146.
Celery—
blanching, effect of ethylene gas, N.J., 734.
blanching methods, Ill., 834.
blights, control, Ohio, 444.
effect of ethylene gas on, Mich., 424.
experiments, 514.
fertilizer experiments, N.J., 734; R.I., 640.
heart rot, notes, Utah, 45.
heart rot, relation to insects and weather, 239.
paper mulch experiments, Ohio, 440.
pollination and fertilization, 427.
quality, relation to structure, Ill., 834.
ripening with ethylene gas, Minn., 39.
yellows, identity and transmission, Calif., 238.
yellows resistant strain, tests, Mich., 444.
Cellars, making dry, U.S.D.A., 882.
Cellophane, use in determining stomatal aperture, 425.
Cells, living, permeability studies, 120, 121.
(*See also* Plant cells.)
Cellular physiology, lecture on, 741.
Cellulose—
acetates, production and physical properties, 10.
fermentation, 810.
in *Eucalyptus regnans*, determination, 803.
Cel-O-Glass as medium for ultra-violet radiation of chicks, N.J., 763.
Cement—
concrete fence posts, design and manufacture, 280.
fire-resistant, 282.
mortar specimens, strength, effect of moisture, U.S.D.A., 878.
Centipede, garden, notes, Ohio, 450.
Centipede, greenhouse, life history and control, Ind., 668.

Cephus cinctus. (*See* Sawfly, western wheat stem.)
Ceratitis capitata. (*See* Fruit fly, Mediterranean.)
Ceratophyllus fasciatus. (*See* Rat flea.)
Ceratostomella fimbriatum, notes, N.C., 745.
Cerveris bicornuta, notes, S.C., 453.
Cercospora—
  cerasella, notes, 841.
  neriella, notes, 841.
  rubi, notes, N.C., 745.
  spp., notes, 240.
Cercosporella—
  albo-maculans, synonymy, 240.
  brassicae, notes, 240.
Cereal—
  diet, high, effect on infants, 892.
  diseases, studies, Kans., 144.
    (*See also specific hosts.*)
  rotation tests, Ohio, 423.
  rust fungi, infection conditions, 534.
  rusts, production by hypodermic injection of inoculum, 445.
    (*See also* Rust *and specific hosts.*)
  seed treatment. (*See* Seed treatment.)
  seeds, symbiotic fungi of, relation to proteins, 22.
  smuts, production by hypodermic injection of inoculum, 445.
    (*See also specific hosts.*)
Cereals—
  duty of water experiments, Oreg., 27.
  germinating, vitamins B and C in, variation, 295.
  studies, Calif., 328.
  (*See also* Grain *and specific grains.*)
Ceresa bubalus. (*See* Buffalo treehopper.)
Ceric acid, studies, Ohio, 445.
Certified Milk Producers' Association of America, proceedings, 563.
Cestodes, nomenclature, 350.
Chabertia ovina, notes, Oreg., 768.
Chaetopsis aenea, notes, Iowa, 353.
Chain store policy, reaction on producers, 688.
Chalcid fly in alfalfa seed, Utah, 54.
Cheat hay, cost of production, Oreg., 685.
Cheese—
  boxes, reinforced and unreinforced, strength, 279.
  Cheddar, effect of additions to milk for, Idaho, 869.
  cottage, making on the farm, Kans., 468.
  effect of amount of salt and method of salting, 369.
  factory, establishment, U.S.D.A., 67.
  fresh unripened, from skim milk, 767.
  from pasteurized milk, microbiology, 672.
  making, heating curd in, new process, Wis., 171.
  making, slow development of acidity in, 266.
  making, treatise, 267.
  process, manufacture, Wis., 170.
Cheese—Continued.
  Romadur, ripening, bacteriological analyses, 672.
Chelidonium cinctum of south India, 455.
Chemical analysis, potentiometric volumetric method, 308.
Chemicals, effect on decomposition of sewage sludge, N.J., 480.
Chemistry—
  agricultural bacteriological, Wis., 107.
  agricultural, laboratory of Chinese Eastern Railway, notes, 600.
  effect on civilization, 291.
Cherries—
  activities during ripening and time of picking, Oreg., 643.
  breeding experiments, S.Dak., 39.
  canned, studies, Oreg., 36.
  cracking injury, cause, Idaho, 831.
  culture experiments, N.Dak., 735.
  fruitfulness in, 526.
  fungus parasites of, 348.
  harvesting and handling studies, Oreg., 35.
  pollen viability, 527.
  pollination studies, 526; Mich., 230.
  rootstock investigations, Utah, 37.
  sour, culture, Kans., 138.
  spray removal from, Oreg., 35.
  spray schedules for, W.Va., 442.
  varieties, N.Y.State, 340.
  vitamins in, Kans., 193.
Cherry—
  aphid outbreaks, Wis., 154.
  brown rot, studies, Wis., 148.
  fruit fly, notes, Mich., 450.
  fruit moth, notes, 354.
  leaf beetle, studies, Oreg., 52.
  maggot, notes, 358.
  pollen handling for long-distance shipment, 527.
  seedlings, studies, N.Y.State, 524.
Chestnut curculio from China, description, 359.
Chestnut oak, light requirements, 42.
Chicken—
  mite in nest of house wren, 360.
  pox immunization, Ind., 371; Oreg., 68, 69.
Chickens—
  antirachitic factor in, formation and function, N.J., 764.
  Hawaiian, parasitic worms of, 573.
  resistance to parasitism, Kans., 173.
  (*See also* Chicks, Fowls, Hens, Poultry, *and* Pullets.)
Chicks—
  age at first feeding, 65.
  baby, effects of early feeding, Wis., 165.
  baby, yolk absorption studies, Calif., 365.
  care, management, and feeding, N.J., 367.
  day-old, reducing mortality in, seven-point program, N.J., 367.

Chicks—Continued.
development, effect of meat meal v. *milk in, N.C., 764.*
effect of ultra-violet radiations through Cel-O-Glass, N.J., 763.
internal disinfectants for, tests, R.I., 676.
milk and meat proteins for, value, 667.
nutrient requirements, Nebr., 862.
nutrition, calcium-phosphorus ratio in, Ohio, 456.
rapid-feathering, growth rate, N.H., 166.
rations for, Iowa, 366.
resistance to parasitism, relation to vitamin D, 474.
sex ratio, relation to antecedent egg production, 863.
simple v. complex rations for, 862.
Chicory—
as sugar plant in Russia, 828.
planted at intervals, germination and yield, 29.
Children—
diabetic, studies, 796.
food requirements. (*See* Infants, feeding.)
good food habits, U.S.D.A., 490.
growth curve, seasonal variation in, Kans., 191.
nutrition, relation to teeth defects, 892.
pre-school, seasonal growth, Ohio, 489.
school, growth relation to milk consumption, 587.
(*See also* Boys, Girls, *and* Infants.)
Chili peppers—
control of weevils on, Calif., 351.
irrigation experiments, N.Mex., 236.
(*See also* Peppers.)
Chilo simplex, notes, 857.
Chilocorus bipustulatus, notes, Calif., 351.
Chinch bug—
barriers, Kans., 152.
damage to St. Augustine grass, U.S.D.A., 856.
hibernating quarters, Kans., 152.
puncture of plant cells, nature, Kans., 153.
Chionaspis pinifoliae, studies, 250.
Chir pine forests, slash in, 532.
Chlorate poisoning of sheep *on treated* pastures, Idaho, 874.
Chlorates for weed control, Idaho, 823.
Chlorides, determination, 413.
Chlorides, effect on penetration of dye into Nitella sap, 120.
Chlorine—
effect on quality of tobacco, Conn. State, 136.
in swimming pools, orthotolidine test for, Mich., 411.
Chlorophyll—
chemistry of, 625.
distribution in variegated plants, 214.
in leaves, relation to oil sprays, 544.
Chloropicrin, value for citrus fumigation, Calif., 350.
Chloroplast pigments in soybeans, development, effect of minerals, 324.
Chlorosis—
effect of iron salt solutions, Calif., 322.
lime-induced, due to manganese deficiency, 533.
of corn, cause, Mass., 843.
of fruit trees, treatment, 243.
of pear trees, treatment, Calif., 342.
of *plants, effect of iron sulfate* and iron citrate, N.Mex., 236.
of trees and shrubs, Idaho, 847.
Cholesterol, irradiation, relation to antirachitic vitamin, 195.
Choppers, motor-driven, for green feed, Oreg., 79.
Chromic acid, action on gossypol derivatives, 802.
Chromium plating for farm machinery, value, Mich., 772.
Chromosomes—
number in Agropyrons, 721.
number in apple and grape, 24, 517.
number in Indian cotton, 629.
number in iris, 24.
number in Vitis and Pyrus, 24.
variations in, Calif., 326.
Chrysanthemum aphid, toxic spray for, Md., 656.
Chrysanthemum leaf spot diseases, comparison, 654.
Chrysanthemums, breeding, Mich., 41.
Chrysocharis elongatus, notes, 856.
Chrysopa sp., notes, 549; Calif., 351.
Church, rural. (*See* Rural.)
Churn sanitation, studies, 672.
Cicada, periodical, notes, Conn.State, 547.
Cicadula sexnotata. (*See* Leafhopper, six-spotted.)
Citranges, notes, Calif., 341.
Citric acid—
modification of milk for infant feeding, Wis., 191.
use in starter cultures, 564.
Citricola scale, studies, Calif., 350.
Citrus—
aphid, green, biology and control, 548; Fla., 754.
borer, large, of south India, 455.
constituents, cytological study, 322.
diseases, studies, Calif., 341.
fruit decay, *effect of* ultra-violet radiation, 50.
fruits, cost of handling from tree to car, Fla., 782.
fruits, decay produced by inoculations with fungi mixtures, 747.
fruits, ripening, effect of heat, Calif., 336.
fruits, translocation of water from twigs into, Calif., 322.
(*See also* Lemons, Oranges, *etc.*)
fumigation, tests of materials, Calif., 350.

Citrus—Continued.
leaves, ash of, Calif., 322.
leaves, palisade tissues, studies, Calif., 322.
mealybug, toxic spray for, Md., 656.
species, diploid, triploidy in, Calif., 326.
species identification, 837.
stock and scion, chemical relation, 529.
tree psorosis, history and treatment, 653.
tree scaly bark, history and treatment, 653.
trees, fertilizer experiments, Calif., 335.
water consumption under irrigation, Calif., 378.
Cladosporium—
effusum behavior on pecan varieties, 245.
fulvum, control, 841.
fulvum, control in greenhouses, Mass., 448.
Clasterosporium carpophilum, biology, importance, and control, 348.
Claw-fingered family, occurrence, 820.
Clay—
capillary movement and entrapped air in, U.S.D.A., 878.
Ontonagon, fertilizer experiments, Mich., 714.
soils, drainage, Utah, 18.
Clearfield State Forest Tree Nursery, 42.
Clearing house organization development, eastern, 688.
Climate—
effect on agriculture in Russia, 416.
effect on agriculture in Thuringia, 809.
of Colorado, Colo., 205.
of Netherlands Indies, 205.
(*See also* Meteorology.)
Climatological data. (*See* Meteorological observations.)
Clostridium—
botulinum. (*See Bacillus botulinus.*)
chauvoei, studies, Kans., 172.
nigrificans n.sp., notes, Iowa, 611.
Clothes moth, tests of moth-proofing material, 853.
Clover—
duty of water experiments, Oreg., 27.
hay, cost of production, Oreg., 685.
mildew, control, Idaho, 838.
nodule production, Wis., 127.
notes, Miss., 423.
planted at intervals, germination and yield, 29.
red, breeding experiments, N.J., 724; Tenn., 127.
red, fertilizer experiments, N.C., 715; Va., 716.
red, hardiness relation to origin, Can., 31.
red, mildew, control, Ind., 342.
Clover—Continued.
red, seeding experiments, Miss., 435; Oreg., 27.
red, source tests, Ind., 220; Wis., 128.
red, varieties, 518.
red, variety tests, Md., 823; N.C., 725; N.J., 724; Oreg., 26; Tenn., 127; Va., 726.
strains, native and foreign, in West Virginia, tests, 520.
sweet. (*See* Sweetclover.)
white, effect of superphosphate, Conn. Storrs, 431.
Clovers, variety tests, Tenn., 127.
Club work. (*See Boys' and Girls'.*)
Cobalt added to iron, effect on blood regeneration, 590.
Coccidia—
in chickens, control, 573.
in chicks, treatments, Ohio, 473.
parasitic specificity, studies, 375.
reinfection of fowl, prevention, 876.
Coccidiosis—
control, N.J., 769.
in poultry, 375, 573; Mich., 408; *Oreg.*, 69, 74.
in rabbits, 678.
rickets as secondary manifestation, 678.
spread, prevention, N.H., 175.
treatment, powdered buttermilk for, Mich., 763.
Coccidium, new, of cattle, 373.
Coccinella—
oculata, notes, 549.
transversalis, notes, Calif., 351.
Coccinellidae from Trinidad to control *Aspidiotus destructor*, 659.
Coccophagus gurneyi—
n.sp., introduced into California, 456.
notes, Calif., 351.
Coccotrypes dactyliperda, notes, 855.
Coccus pseudomagnoliarum, studies, Calif., 350.
Cockchafer, flight stimulus and other activities, 753.
Cockroach, German, toxic spray for, Md., 656.
Cockroaches, toxicity of hydrocyanic acid for, 656.
Coconuts, insects affecting, 753.
Codling moth—
activity, unsprayed check tree as indicator, 251.
behavior, effect of artificial light, 251.
control, 251, 552; Colo., 151; Ind., 352; Kans., 137; Wash.Col., 550.
control, baits for, N.Mex., 247.
control in Arkansas, 756.
control, results of government tests, 354.
control with substitutes for lead arsenate, 756.
egg laying date, determination, N.H., 154.

Codling moth—Continued.
emergence, thermal constant for, N.J., 749.
in Pacific Northwest, control, U.S.D.A., 660.
in walnuts, control, 851.
larva, head and mouthparts, morphological studies, 756.
larvae, attractiveness of bands to, 252.
larvae, hibernating, control, 547.
larvae, location of winter quarters, N.J., 749.
larvae on pears, laboratory studies in control, 757.
larvae, relative resistance of strains to arsenicals, 155.
life history in northern Georgia, U.S.D.A., 453.
notes, Idaho, 848; Ohio, 450; Va., 752.
on walnuts, control, Calif., 350.
oviposition, effect of breeze, Kans., 151.
spraying recommendations, Mass., 849.
sprays, timing, N.J., 749.
studies, Oreg., 52, 53.
tropisms and sense organs, 660.
Cod-liver meal, antirachitic value, 63.
Cod-liver oil—
and malt extract emulsions, composition, 387.
effect on growth in chicks, 668.
effect on growth in pigs, 666.
effect on phosphorus and calcium metabolism of infants, 496.
effect on poultry, Idaho, 861; N.C., 764.
fluorescence, measurement, 292.
in cow's ration, effect on milk composition, 264.
stearin, vitamin D in, Ind., 365.
v. ultra-violet irradiation for rickets prevention, 294.
vitamin A in, 894.
vitamin D in, variations, 695.
vitamins A and D in, relative amounts, 894.
vitamins in, chemistry, 695.
vitamins, utilization by cows, Wis., 168.
Coffee—
acclimatization tests, 529.
culture and handling, Hawaii, 732.
insects affecting, 657, 850.
Sclerotium disease, notes, 648.
Cold storage holdings, U.S.D.A., 85.
Coldframes and hotbeds, construction and management, N.Mex., 87.
Colds, susceptibility to, effect of ultraviolet irradiations, 795, 796.
Coleoptera molts, inconstancy in number, 753.
Collards in calcium hydroxide, 626.
Colleges. (See Agricultural colleges.)
Colletotrichum—
circinans, notes, 647.
Colletotrichum—Continued.
gloeosporioides, notes, 245; Calif., 341.
kiotoense n.sp., description, 647.
lindemuthianum, notes, 843.
Colloids—
of soil profiles, variation in, Ohio, 417.
soil, properties, effect of substituted cations, 419.
Collybia dryophila, notes, N.C., 745.
Color mutations of *Puccinia graminis tritici*, 237.
Colorado Station, notes, 598.
Colorado Station, report, 197.
Combines—
American, field tests in Germany, 683.
effect on farm organization, Kans., 182.
harvesting experiment, N.Dak., 726.
harvesting losses with, Ind., 377.
in Michigan, Mich., 772.
needed changes for Virginia conditions, Va., 772.
results in Canada, 881.
studies, Idaho, 876.
use in North Dakota, N.Dak., 777.
use in Ohio, Ohio, 882.
use in Pennsylvania, Pa., 777.
Commission merchant, regulating, paper on, 688.
Commodity studies, 283.
Communication and transportation, 570.
Community—
development study, Va., 788.
halls, establishing and financing, Mont., 690.
shade tree spraying for Japanese beetle, 855.
studies, 283.
(See also Rural community.)
Complement fixation test for identifying types of virus in foot-and-mouth disease, 268.
Compositae, distribution, relation to pH of soil, 719.
Concrete—
in tension, U.S.D.A., 78.
pavements, design of cross section, U.S.D.A., 775.
pavements, progressive cracking in, mechanics, U.S.D.A., 775.
pavements, quality, relation to coarse aggregate, U.S.D.A., 878.
pavements, surface hardness, indicating, U.S.D.A., 775.
paving, qualities required in, U.S.D.A., 78.
reinforced, failure in compression, 477.
strength, effect of coarse aggregate, U.S.D.A., 775.
test cylinders, capping experiments, Colo., 177.
Conductivities of small volumes of liquids, measurement, apparatus, 208.
Confections, use of fruits in, Oreg., 89.
Coniferous seedlings, effect of high temperature, Calif., 340.

Conifers—
- *damping-off of, control, N.Y.Cornell,* 748.
- fruit cast, studies, 349.
- nitrogen metabolism, 22.
- seeds, testing at Yale School of Forestry, 236.
- seeds, use of term air-dry, 236.
- soil fertility studies, Idaho, 811.
- western, key, 42.

Coniothyrium—
- *fuckelii, notes,* N.C., 745.
- sp., notes, 244.

Connecticut—
- College, notes, 97.
- plan of taxation for public schools, 287.
- State Station, notes, 798.
- Storrs Station, notes, 97, 299.
- Storrs Station, reports, 197.

Conotrachelus nenuphar. (*See* Plum curculio.)

Construction operations in cold weather, treatise, 478.

Contarinia sorghicola, parasite of, studies, 254.

Cooking—
- in rural homes, fuels for, Ind., 394.
- with electricity, Iowa, 394.

Cooperation. (*See* Agricultural cooperation *and* Marketing.)

Cooperative—
- buying in West Virginia, W.Va., 888.
- movement, Government's policy toward, U.S.D.A., 688.

Copper—
- added to iron, effect on blood regeneration, 590.
- as supplement to iron in hemoglobin formation in blood, Wis., 193.
- determination in biological materials, 612.
- dusts, time of application to potato plants, Ohio, 444.
- in powdered whole milk, nutritional value, 491, 565.
- nitrate as herbicide for mustard, strength, N.H., 127.
- powders for bunt prevention, 534.
- relation to yeast effect on lactation, 92.
- sulfate as herbicide for mustard, strength, N.H., 127.
- supplementary value for milk diet, 490.

Corn—
- aluminum in, detection, Mich., 712.
- and beans, interplanting, Miss., 433.
- and kafir stubble, decomposition rates, 620.
- and peas, hogging down, N.Dak., 763.
- and rape, hogging down, U.S.D.A., 761.
- and soybeans, deficiencies as complete ration, Ind., 866.
- and soybeans, interplanting test, Miss., 433, 435.

Corn—Continued.
- as sugar plant in Russia, 828.
- ash content, factors affecting, Utah, 409.
- billbug, studies, S.C., 453.
- borer, European—
  - and environment, Ohio, 56.
  - clean-up operations, Conn.State, 547.
  - control, Ill., 357; Ind., 352.
  - control, device for, Mich., 475.
  - control, effect of topping corn, Mich., 454.
  - damage, factors affecting, 253.
  - host plants in New England, U.S.D.A., 56.
  - in Pennsylvania, 552.
  - in southwestern France, 253.
  - in stored corn, behavior, Ohio, 454.
  - in western New York, N.Y.State, 155.
  - increase, N.H., 153.
  - infectious diseases of, 662.
  - infestation, effect of soil type, Miss., 435.
  - killing in ear corn, heat and time of exposure, U.S.D.A., 852.
  - laboratory breeding, 662.
  - notes, Ohio, 450.
  - nutrition as factor in responses of, 253.
  - parasite of, 856.
  - parasites, imported into America, U.S.D.A., 57.
  - reduction, low-cut stubble as factor, Mich., 851.
  - research program, 1928, U.S.D.A., 553.
  - research program, 1929, U.S.D.A., 553.
  - research, report of conference on, U.S.D.A., 552, 553.
  - situation in Ontario, 663.
  - situation in United States in 1928, 253.
- borer, 4-lined, notes, Iowa, 354.
- breeding experiments, 29, 330, 825; Kans., 125; N.C., 725; N.J., 724; Tenn., 127; Va., 726.
- Canadian, classification, Can., 32.
- chlorophyl defect in, 216.
- chlorosis, cause, Mass., 843.
- cross, relation between length of styles and Mendelian segregation in, 216.
- crosses, composition, Iowa, 338.
- culture experiments, 330; Kans., 125; Nebr., 824; Tenn., 127.
- disease resistance, Iowa, 344.
- disease resistant strains, development, 327.
- downy mildew, notes, Iowa, 344.
- dry land culture, U.S.D.A., 724.
- dry rot diseases, studies, Iowa, 344.
- ear and kernel characters, relation to yield, Iowa, 220.
- ear rot, control, Calif., 844.

Corn—Continued.
ear rots, studies, S.Dak., 46.
ear smut, relation to husk covering, U.S.D.A., 745.
ear worm as cotton pest, U.S.D.A., 756.
ear worm attack, relation to shuck covering, 331.
ear worm, studies, Kans., 152.
effect of fertilizers, Ind., 328.
effect of manganese, Ind., 338.
embryos, effect of temperature, Wis., 146.
enterprise in Iowa, Iowa, 483.
fat metabolism, effects of waxy gene in, 22.
fertilizer applications, methods, Ohio, 433.
fertilizer experiments, 330; Ind., 329; Miss., 433, 436; N.C., 715; Va., 716, 727.
fertilizer ratio experiments, Ga., 118.
field and sweet, polysaccharides in, Md., 632.
fields, insect census, Kans., 152.
germinator electrically operated, Ind., 377.
harvesting, husker-shredder for, U.S. D.A., 78.
harvesting with field silage cutter, Ohio, 478.
heritable characters in, 122.
hetero-fertilization in, 216.
hogging down, N.C., 762; U.S.D.A., 761.
hogging down, gains in, Ind., 363.
husks, digestibility, S.Dak., 66.
hybrids, adaptability to soil conditions, variability, Ind., 342.
hybrids, notes, Wis., 127.
immature, hogging down, N.C., 762.
improvement studies, Iowa, 329.
insects affecting, Kans., 152.
irrigation experiments, Utah, 27.
leaf aphid, biological studies, Kans., 152.
leaf aphid, notes, 539.
linkage studies, 216.
lodging in selfed lines and crosses, 122.
metabolism, climatic effects in, 22.
multiple ear character in, 330.
plant morphology, relation to smut infection, Iowa, 344.
planting dates, Mich., 498.
plants, iron accumulation in nodes, Ohio, 445.
production, tillage practices in, Nebr., 129.
recessive defects and yield in, 331.
red-to-white mutation in, 630.
red, vitamin A in, Ind., 368.
root rots, control, N.J., 742; Ohio, 444.
rootworm, control, N.C., 752.
rootworm, southern, life history, Kans., 152.
rootworm, southern, studies, Ark., 58.
rootworms, studies, Kans., 152.

Corn—Continued.
rotation experiments, U.S.D.A., 724.
rust resistance, nature of, 535.
scab, epidemic, Wis., 149.
seed, curing, Wis., 127.
seed treatment, Kans., 125; Miss., 433; Nebr., 824.
seed treatment, effect, Wis., 149.
seedling blight, notes, Wis., 148.
seedlings, secondary seminal roots in, development, 633.
seminal roots, relation to various characters, 221.
shelled v. corn-and-cob meal for calves, Ohio, 457.
shelled v. ground for cattle, Ohio, 457.
shuck covering, relation to ear worm attack, 331.
silage. (See Silage.)
smut spores, viability, effect of digestive processes, 445.
smut, studies, Kans., 145.
(*See also* Cereal smuts.)
spray schedule for, 753.
storage tests, Iowa, 329.
stover harvesting, Iowa, 377.
sugar in, relation to available potash, Ind., 338.
sweet. (*See* Sweet corn.)
table and canning quality, relation to kernel density, U.S.D.A., 38.
teopod, morphological nature, 825.
topping, effect on borer control, Mich., 454.
2n-1 chromosomal chimera in, 215.
utilization by different methods, N.C., 762.
variegated pericarp, frequency of somatic mutation in, 722.
varietal comparisons, Kans., 126.
varieties, Miss., 435.
varieties for silage, Utah, 638.
varieties, regional and seasonal adaptation, Tex., 633.
varieties, variation in borer infestation, Miss., 434.
varieties, Wisconsin, grown in Nebraska, effects, Wis., 127.
variety tests, 330; Idaho, 823; Ind., 329; Kans., 125; Mich., 432, 498; Miss., 433, 436; N.C., 725; N.Dak., 726; N.J., 724; N.Mex., 219; Nebr., 824; Oreg., 26; Tenn., 127, U.S.D.A., 724; Utah, 27; Va., 726.
yellow stored, vitamin A in, Ohio, 456.
yellow v. white, for pigs, W.Va., 162.
yields, effect of lime and legumes, N.C., 725.

Cornell University, notes, 897.

Cornstalk borer, southern, notes, Va., 752.

Cornstarch, stiffness in fabrics produced by, U.S.D.A., 497.

Corpora lutea—
extracts of sows, effect on ovulation in rats, 632.
function, 632.
production experiments, 631.

Corticium—
koleroga, studies, 287.
solani, notes, 241.
stevensii, identity, 287.
vagum, notes, Wis., 147.
Coryneum beijerinckii, control, 348.
Cost of living on farms, Ohio, 481.
Cost of production studies, Iowa, 381.
(*See also specific crops.*)
Cotton—
anthracnose, control, N.C., 744.
black arm, location of causal organism, 844.
boll, development, effect of removal of involucre, 221.
boll disease, internal, notes, 842.
boll shedding, control, 842.
boll weevil. (*See* Boll weevil.)
bollworm. (*See* Bollworm.)
breeding experiments, Tenn., 127; Va., 726.
bug, red, notes, 842.
cost of production, reducing, 885.
crosses, inheritance in, 629.
crosses, studies, N.C., 728.
cultivators, efficiency study, N.C., 770.
culture and production costs in Philippines, 331.
culture experiments, Ga., 634; Tenn., 127.
differences in seedling stands, determination, 437.
diseases important in Tennessee, control, Tenn., 147.
diseases in Egypt, 536.
diseases, seed-borne, seed treatment for, Miss., 446.
dusting and spraying experiments, 658.
dusting with calcium arsenate for boll weevil control, Ala., 453.
early history, 635.
effect of concentrated fertilizers, N.C., 622.
fabrics, effect of laundering, 897.
fabrics, protective value, Kans., 196.
farmers, credit problems, Ga., 685.
fertilizer experiments, Ala., 130; Ga., 634; Miss., 433; N.C., 728; Tenn., 127; U.S.D.A., 31; Va., 726, 727.
fertilizer ratio experiments, Ga., 118.
flowering date, relation to soil salinity, 31.
flowers, self-fertilization methods, 826.
gin fires, causes and *prevention*, U.S.D.A., 479.
growers' association, Oklahoma, attitudes of farmers toward, Okla., 484.
Growing Association, British, report, 635.
hair, cell wall, properties, 897.
hybrid, hairy bolls and nectaries in, 826.
in British Togoland and Trans-Volta district, insects affecting, 248.
in Egypt, research in, 826.
Indian, chromosome numbers, 629.
Cotton—Continued.
insects affecting in Peru, 247.
irrigation, studies, Calif., 378.
leaf temperatures, U.S.D.A., 30.
leaf worm, control, 658.
leaf worm, migratory habits, 357.
marketing, Ga., 179.
nondehiscence of anthers in, 222.
percentage of motes, 826.
pests in Egypt, control with arsenicals, 657.
publications in English, list, U.S.D.A., 520.
root rot, control, 745.
root rot fungus, prolonged saprophytic stage, U.S.D.A., 446.
root rot, plants susceptible or resistant to, relation to control, Tex., 536.
seed. (*See* Cottonseed.)
sore shin, control, N.C., 744.
sore shin, prevention tests, 536.
spacing experiments, Miss., 433; N.C., 728; N.Mex., 219.
standard Indian, reports, 698.
variety tests, Miss., 432, 433; N.Mex., 219; S.C., 31; Tenn., 127; Tex., 826.
wilt, control, 345, 842; Miss., 446.
wilt, effects of potash fertilizer, Miss., 446.
wilt, studies, Ark., 536.
Cottonseed—
fumigation for destruction of pink bollworm, 258.
grown in New Mexico, composition, N.Mex., 728.
lint percentage, factors affecting, Ga., 124.
meal, effect on milk, N.J., 765.
meal, feeding value, 262; Ind., 664; Kans., 162, 167; N.C., 762; N.Mex., 259, 261.
meal injury offset by good rations, Mich., 498.
meal tests with tobacco, Conn.State, 135.
meal v. linseed for steers, Wis., 161.
meal v. linseed meal for wintering calves, Okla.Panhandle, 559.
oil and protein content, N.Mex., 219.
pedigree, effect of seed control law, 826.
sulfuric acid treatment, 843.
toxic principle, preparation and properties, 9.
treatments, N.C., 744.
treatments, dust and liquid, Ga., 144.
Country Life Conference. (*See* National.)
Country life movement, American, 579.
(*See also* Rural.)
Cover crops—
effect on tobacco, Conn.State, 135.
for cotton, comparison, Miss., 433.
for oil palm plantations, 529.
variety tests, Va., 726.

Cowbirds, evolution and parasitic habit, 848.
Cowpeas, breeding experiments, Va., 726.
Cows—
dairy, feeding experiments, 262.
dairy, milk yield, 671.
dairy, weight variations, factors affecting, U.S.D.A., 671.
diseases of the reproductive organs, Mich., 468.
effect of plane of feeding on milk production, U.S.D.A., 670.
feeding methods, Nev., 561.
fermented feed for, value, Wis., 169.
milk production. (*See* Milk production.)
mineral metabolism, factors affecting, Kans., 166.
on pasture, supplements for, Ind., 368.
udders. (*See* Udder.)
utilization of cod-liver oil vitamins, Wis., 168.
(*See also* Calves, Cattle, *and* Heifers.)
Crab apples—
American wild, hybridization, 430.
culture experiments, N.Dak., 735.
culture, origin and varieties, Ohio, 527.
large-fruited type, origin, 427.
of Japan, 230.
varieties, N.Y.State, 340.
Crambinae, Japanese, paper on, 55.
Cranberries—
culture, Wash.Col., 141.
culture in Netherlands, origin and development, 235.
insects affecting, Mass., 849; N.J., 751.
mineral constituents, 491.
studies, Mass., 832; N.J., 739.
Cranberry—
black bug, life history, Mass., 850.
bogs, lead arsenate studies on, N.J., 451.
false blossom disease, studies, Mass., 846.
products, manufacture and preservation, Mass., 889.
root grub, control, Mass., 850.
roots, injury from copper on sanded bogs, N.J., 747.
rot, control, N.J., 747.
storage rots, notes, 244.
white grub, control, Mass., 850.
Crataegus oxyacantha leaf spot, notes, 841.
Cream—
cost of handling in country plants, N.Y. Cornell, 183.
factory tests, Idaho, 808.
producers' method of disposing of, Ind., 880.
separator, handling to avoid fat losses, Okla.Panhandle, 170.
tests, variation in, causes, Okla.Panhandle, 67.
unpasteurized, microscopic appearance, N.Y.State, 562.
Creamery—
license division, report, Ind., 285.
operation, essentials for, U.S.D.A., 67.
Creatinine excretion and creatinuria of women, 191.
Cremastogaster sp., notes, 847.
Cremastus hymeniae, notes, 357.
Crepis, genetic studies, Calif., 326.
Cricket—
black field, notes, S.Dak., 53.
Mormon, outbreak and parasites, Mont., 153.
snowy tree, control, Calif., 351.
Crickets on cotton in California, U.S.D.A., 754.
Crioceris spp. (*See* Asparagus beetle.)
Crithidia melophagia from sheep's blood, cultivation, 69.
Cronartium ribicola. (*See* White pine blister rust.)
Crop—
insurance, outlook, 285.
pests of field and garden, Mich., 656.
reports, U.S.D.A., 85, 188, 384, 487, 584, 787, 887.
rotations. (*See* Rotation of crops.)
sequence studies, N.Dak., 726.
yields relation to base exchange in soil, Kans., 117.
Crops—
acreages and yields in 1928, Iowa, 884.
drought resistance, Kans., 121.
dry land, experiments, U.S.D.A., 724.
dry land, pasturing with hogs, U.S.D.A., 760.
economic study in purchase region, Ky., 782.
effect on following crops, Va., 727.
growth, effect on replaceable bases in soil, 208.
introduction into Russia, Calif., 327.
ion concentration with, differences, Calif., 335.
road-oil injury to, Wis., 150.
temperature relations, Kans., 121.
utilization experiments, U.S.D.A., 761.
water requirements, factors affecting, 327.
(*See also* Field crops *and specific crops*.)
Crossing-over in mice, 820.
Crotalaria retusa as cover crop for palms, 529.
Crown gall and callus knot on apple nursery stock, control, 231.
Crown gall and hairy root, studies, Wis., 148.
Crucifers, planted at intervals, germination and yield, 29.
Crude fiber. (*See* Cellulose.)
Cryptognatha nodiceps for control of *Aspidiotus destructor*, 659.
Cryptolaemus montrouzieri—
and its allies, 246.
notes, Calif., 351.
paper on, 657.

Ctenocephalus canis, notes, 660.
Cucumber beetle—
spotted, studies, Ark., 58.
striped, control, N.J., 751.
12-spotted, control, 554.
12-spotted, toxic spray for, Md., 656.
Cucumber beetles—
account, N.Y.State, 662.
control, 554; N.Y.State, 554.
thermobyetics of, 52.
Cucumber—
downy mildew, studies, Mass., 830.
mosaic tissue, intracellular bodies in, 843.
mosaic virus transmission, studies, 549.
Cucumbers—
greenhouse, genetics, Mass., 833.
paper mulch tests, Mich., 37; Ohio, 440.
spray schedule for, 753.
Cucurbit downy mildew, control, Ga., 144.
Cucurbita sp., fruit shapes, developmental history, 429.
Cultivators, efficiency study, N.C., 776.
Culture media, change of reaction in, 627.
Curculio haroldi, description, 359.
Currants—
black, reversion, symptoms and diagnosis, 348.
culture, N.Y.State, 644.
Cuscuta monogyna, physiological studies, 818.
Cutworms—
control, Mass., 849.
detection in the field, Wis., 154.
notes, Iowa, 353.
poison bait for, Mich., 450.
Cyanamid, properties and uses, U.S.D.A., 815.
Cyanide, value for citrus fumigation, Calif., 350.
(*See also* hydrocyanic acid.)
Cyclamen seed germination, improvement, N.J., 734.
Cycloneda sanguinea, notes, 549.
Cydonia japonica, witches' broom on, 654.
Cysteine and carbon monoxide reactions with compounds of metals, 502.
Cystine, alkaline decomposition, 107.
Dacus oleae, control, 358.
Dairy—
barn floors, Iowa, 377.
barn floors, winter temperature, Kans., 178.
barns from manufacturing point of view, 680.
can washing machines, 479.
cattle and dairy cows. (*See* Cattle *and* Cows.)
Day, program, Ohio, 66.
equipment, continuous can washer, Calif., 282.
equipment, corrosion of metals in, 866.
equipment, sterilizing, effectiveness of sodium hypochlorite in, 564.
experiments, Ohio, 66.
Dairy—Continued.
farming in northwestern Indiana, Ind., 380.
herd improvement through purebred bulls, Idaho, 766.
industry in Michigan, status, Mich., 288.
industry in United States, outlook, 285.
products, factory tests, Idaho, 808.
sires. (*See* Sires.)
stable ventilation, studies, 576.
statistics, U.S.D.A., 384.
sterilizer, electric, studies, Calif., 376.
utensils, electric sterilizers for, Oreg., 75.
utensils, sterilization with humidified hot air, Calif., 467.
Date palms—
Diplodia affecting, Calif., 341.
origin and culture, 529.
Date seeds, brown scolytid on, 855.
Dates, ripening with ethylene gas, Minn., 39.
Dates, sugar content, Calif., 336.
Datura chromosomes, behavior, 215.
Deciduomata, experimental production, 632.
Delaware Station, notes, 97, 499, 798.
Delaware University, notes, 97, 499.
Delphinium spp., oils and alkaloids, insecticidal tests, 248.
Deltocephalus spp., introduction and distribution, 249.
Dendroctonus frontalis. (*See* Pine beetle, southern.)
Department of Agriculture. (*See* United States Department of Agriculture.)
Depressaria heracliana. (*See* Parsnip webworm.)
Dermacentor andersoni—
in sheep, pathological conditions, 656.
notes, 372.
Dermacentor occidentalis, tularemia infection in, 856.
Dermanyssus gallinae in nest of house wren, 360.
Dermaptera of New Jersey, revised list, 247.
Dermestes spp., biology, 753.
Derris, chemistry of, 543.
Derris, insecticidal properties, 549.
Deutzia, forcing experiments with calcium cyanide, 837.
Dewberries—
fertilizer experiments, N.C., 735.
production, Mo., 836.
varieties, Miss., 439.
variety, notes, Ga., 136.
Young variety, description, Ga., 739.
Dewberry—
diseases, studies, N.C., 745.
orange rust, notes, Mich., 449.
Dextrin nitrate agar for isolation of *Azotobacter chroococcum*, 316.
d'Herelle phenomenon, studies, 720.
Diabetes—
in children, studies, 796.
Jerusalem-artichokes as source of carbohydrates in, 195.

Diabrotica—
  duodecimpunctata. (See Cucumber beetle, spotted.)
  longicornis. (*See* Corn rootworm.)
  spp., control on cucurbits, Calif., 352.
  vittata. (*See* Cucumber beetle, striped.)
Dialeurodes chittendeni, notes, 357.
Diamino acids in normal and pathological tissues, 806.
Diamond-back moth, control, Kans., 152.
Diarrhea, bacillary white—
  agglutination test, long and short methods, Wis., 173.
  control, 572.
  control in British Columbia, 274.
  control in Pennsylvania, 74.
  diagnosis, Oreg., 69.
  dissemination in incubators, Kans., 176.
  effect of dark brooding on spread, Ohio, 473.
  eradication, Mass., 677.
  in South Africa, 375.
  intermittent reactors to agglutination test, N.C., 770.
  lesions from, 73.
  method of testing fowls for, 273.
  one-tube agglutination test for, Mich., 768.
  papers on, 70.
  pathology, studies, Ind., 371.
  post-mortem examinations, N.H., 176.
  pullorin test v. agglutination test, 73.
  regulatory work in Oregon, 74.
  studies, 474, 874; Idaho, 874; Kans., 172, 173; Mich., 469; N.C., 770; Va., 677, 768.
  summary, Ky., 273.
Diatraea—
  saccharalis. (*See* Sugarcane borer.)
  zeacolella. (*See* Cornstalk borer.)
Dicastious mlanjensis, notes, 659.
Didymella lycopersici, notes, 841.
Diet—
  accessory factors. (*See* Vitamins.)
  calculation of energy, protein, calcium, phosphorus, and iron in, U.S.D.A., 191.
  deficiency diseases. (*See specific diseases.*)
  effect on teeth, 490.
  for dogs, treatise, 261.
  maternal, effect on hemoglobin of nursing young, 792.
  of children. (*See* Children.)
  of infants. (*See* Infants.)
  relation to growth rate, 291.
  (*See also* Food *and* Nutrition.)
Dietary habits of New Zealand, 88.
Diets, vitamin A-free, list, 894.
Digitalis hybrids, matrocliny in flower size in, 217.
Digonochaeta setipennis, parasite of, introduction from Europe, Oreg., 52.
Dill pickles, losses by softening, cause, Calif., 387.
Dilophospora graminis, notes, 841.
3, 5-Dinitrocresol, insecticidal value, N.J., 751.
Diocets punctoria, notes, U.S.D.A., 57.
Dimous sp., notes, Calif., 351.
Diphtheria, avian, immunization, 876.
Diphyllobothrium latum in bears, anthelmintic for, 273.
Diplodia sp., notes, Iowa, 344.
Diplosis sp., notes, Calif., 351.
Diptera—
  of Fiji Islands, 56.
  of German fauna, 55.
  ovarian tubes, effect of hunger in larval stage, 753.
Dirphya princeps on coffee, 850.
Disease resistance and avitaminosis, 495.
Diseases—
  insect-borne, Montana's laboratory for study, 657.
  of animals. (*See* Animal diseases *and specific diseases.*)
  of man and animals, summary, 673.
  of plants. (*See* Plant diseases *and specific host plants.*)
  tropical, diagnosis and treatment, 870.
Distemper of dogs, immunization, 675; Calif., 370.
Dociostaurus maroccanus, studies, 54.
Dodder, physiological studies, 818.
Dog disease, Stuttgart, cause, 278.
Dogs—
  cutaneous lesions in, relation to vitamin B deficiency, 895.
  diet for, treatise, 261.
  ticking factor in, inheritance, 820.
Domestic science. (*See* Home economics.)
Domsiekte, notes, 69.
Douglas fir disease, new, 542.
Draeculacephala reticulata, introduction and distribution, 249.
Dragonflies—
  of North America, handbook, 548.
  parasite of, 574.
Drainage—
  and land development, Mich., 475.
  and reclamation, treatise, 275.
  effect on forests, Wis., 142.
  law in England and Wales, administration, 477.
  mole, tests, Mich., 475.
  of land overlying artesian basins, 477.
  of swamps and forest growth, Wis., 646.
  studies, N.Mex., 275; Utah, 75.
  tanks, report on, Utah, 18.
Draintile tests, Minn., 76.
Drosophila ampelophila. (*See* Pomace fly.)
Drosophila virilis, mutable genes in, 215.
Drought of 1926–27, relation to soil moisture and crop yields, Okla.Panhandle, 825.
Drug, food, and insecticide administration, organization, U.S.D.A., 712.
Drugs, analyses, Conn.State, 890.
Drugs, inspection, Me., 693.

Drymaria pachyphylla poisonous to livestock, N.Mex., 267, 373.
Dryocoetes spp., studies, 557.
Ducks—
Formosan, eye parasite of, 574.
Formosan, nematode parasite of gizzard, 574.
wild and domestic, blood relationship, 262.
Dusting for fungus diseases, summary, 532. (*See also* Spraying *and specific crops.*)
Duty of water. (*See* Irrigation.)
Dye accumulation in Nitella, mechanism, 513.
Dynamometer, torsion, description and use, 680.
Dysdercus cingulatus, notes, 842.
Dysenteria neonatorum of calves, 373.
Dysentery, chronic bacterial. (*See* Johne's disease.)
Dyslobus decorata, notes, Oreg., 52.
Earias insulana, control, 658.
Earthworm fauna of Illinois, changes in, 449.
Earwig, European, parasite of, introduction from Europe, Oreg., 52.
East coast fever. (*See* African coast fever.)
Echidnophaga gallinacea, notes, 660.
Echinococcus granulosus, morphology and bionomics, 267.
Eclampsia, puerperal. (*See* Milk fever.)
Ecology and human affairs, lecture on, 741.
Economic history, American, introduction, treatise, 489.
Education, agricultural. (*See* Agricultural education.)
Education and research, 381.
Egg industry, economic research in, 283.
Egg production—
and hatchability, effect of deficient ration, Kans., 164.
breeding for, Utah, 63.
correlation studies, Iowa, 366.
culling and selecting for, 669.
distribution, Okla.Panhandle, 166.
effect of artificial lights, S.Dak., 62.
feeding for, Iowa, 464.
inheritance in Rhode Island Reds, Kans., 124.
monthly costs and receipts, N.J., 367.
time factor in, 668.
winter, effect of sunlight and cod-liver oil, Wis., 165.
(*See also* Hens, laying.)
Egg products, dehydrated, use in ice cream, N.J., 767.
Egg-laying—
contest, Utah intermountain, rules and regulations, Utah, 764.
contests, report, N.J., 367.
Eggplant—
Verticillium wilt, effect of pH, N.J., 748.
wilt, notes, Mass., 840; Utah, 45.
Eggplants, paper mulch experiments, Ohio, 440.
Eggs—
and egg products, tariff data, 584.
cold storage, U.S.D.A., 787.
cost of production, Okla.Panhandle, 464.
for storage, value, factors affecting, N.Mex., 284.
hatchability, effect of moisture, Iowa, 366.
hatchability, factors affecting, Mich., 763; Ohio, 463.
hatchability, relation to consanguinity of stock, 864.
hatchability, studies, 64.
household storage, effect on antirachitic value, Wis., 195.
incubation. (*See* Incubation.)
marketing, Iowa, 381.
marketing on quality basis, Ind., 380.
outlook chart, U.S.D.A., 887.
preservation, 560.
principles of cookery and recipes, U.S.D.A., 291.
quality, individuality as factor, 863.
soft-shelled, and vitamin D, Wis., 165.
standardization, progress in, 688.
storage experiment, N.Mex., 261.
United States, foreign markets for, 887.
weight, economic significance, N.J., 560.
weight, factors affecting, 864.
weight, inheritance, 326; R.I., 821.
Eimeria ellipsoidalis n.sp., description, 373.
Elachiptera costata, notes, 240.
Electric—
brooders, Oreg., 75.
dairy sterilizers, Oreg., 75.
equipment and appliances, current consumption of, 478.
equipment for farms, N.H., 178.
hay hoisting experiments, Oreg., 75.
household refrigeration on farms, N.H., 897; Nebr., 898.
incubation and brooding, Wash.Col., 379.
motors, small, use, Pa., 880.
plants, unit, for farms, Nebr., 879.
service, rural, from central stations, revenue and consumption, Nebr., 879.
wiring of farmsteads, 880, 881.
Electricity—
effect on plant growth, 426, 427.
for lighting of dwellings and animal shelters, 881.
in agriculture, Idaho, 876.
in cooking, Iowa, 894.
in farm homes, 478.
on farms, 579; Ill., 878; Mich., 772; Mo., 879.
on farms, consumption with well automatic water systems, Nebr., 877.
supply in rural areas, conference on, report, 575.
used by farm refrigerators, S.Dak., 75.

Electrodialysis—
as *means of studying chemical differences in apple tissue*, 516.
technic of, 412.
Elevator organization, economic aspects, Minn., 786.
Elevators, country, margins and marketing costs of Kansas wheat, Kans., 186.
Elm disease, notes, 349.
Elm leaf beetle, toxic spray for, Md., 656.
Elm scurfy scale, control, Ind., 353.
Elm tree disease, notes, 841.
Elms, American, fertilization, 837.
Embryos of chicks, effect of endocrine substances, 632.
Embryos of eight days' gestation in mice, variations, 632.
Emphysema of rumen in a sheep, 69.
Empididae of New Zealand, 357.
Empoasca fabae—
control, 548.
introduction and distribution, 249.
Empoasca mali. (*See* Apple leafhoppers *and* Potato leafhoppers.)
Endive, self-fertilization, Calif., 336.
Endocrine substances, effect on prenatal development of chick embryo, 632.
Energy consumption during canoeing, 191.
Energy in diet, calculation, U.S.D.A., 191.
Engineering—
agricultural, progress in, 275.
department at Kansas Station, notes, 395.
research in, development and progress, Va., 772.
Enteritis—
chronic. (*See* Johne's disease.)
infectious in swine, studies, 73.
Enterohepatitis, infectious. (*See* Blackhead.)
Entomological—
Commission, its protection for horticulturists, 354.
data, analysis by probability methods, 246.
research, *experimental method in*, 246.
research in the Sudan, 657.
Entomology—
agricultural, treatise, 848.
applied, problems, 749.
papers at Pan-Pacific Science Congress, 753.
systematic, principles, 546.
(*See also* Insects.)
Entomophthora sphaerosperma, notes, Mass., 850.
Entomophthoraceae, entomogenous members in artificial culture, 256.
Entomosporium maculatum, notes, 841.
Enzyme action, studies, 11.
Enzymes of *Pythiacystis citrophthora*, 237.
Enzymes, pectic, studies, 720.
Ephestia cautella on dried fruit, 850.
Ephestia kuehniella. (*See* Flour moth, Mediterranean.)
Epiblema carolinana, studies, Mich., 57.
Epiblema penkleriana, paper on, 354.
Epilachna borealis. (*See* Squash beetle.)
Epilachna corrupta. (*See* Bean beetle Mexican.)
Epochra canadensis, notes, Calif., 659.
Ergosterol—
activation, 297.
activation, quantitative biophysical studies, 294.
irradiated—
action, effect of thyroparathyroidectomy, 596.
biological and physical assay value, 596.
by ultra-violet rays v. cathode rays, antirachitic potency, 495
effect of massive doses, 391.
effect on growth of rats, 896.
excessive doses, source of increased calcium, *295*.
for rickets, 795.
use in treatment of rickets, 596.
irradiation, 92, 93.
irradiation, formation or *destruction* of vitamin D during, 695.
irradiation, relation to antirachitic vitamin, 195.
specific color reaction for, 416.
Ergot poisoning by rye bread, 888.
Ergothioneine as substitute for histidine, 90.
Erioglaucine A, new indicator, 501, 502.
Eriogreen B, new indicator, 501, 502.
Eriosoma lanigerum. (*See* Apple aphid, woolly.)
Erosion and run-off experiments in Texas, 574.
Erosion, increased cost of, 284.
Erwinia sp., notes, 246.
Erysiphaceae, biological-morphological studies, 655.
Esca, notes, 50.
Escherichia coli as indicator of efficient *pasteurization of milk*, 867.
Eskimos, metabolism studies, 87.
Ethyl alcohol—
effect on growth of seedlings, 514.
production from corn, fermentation methods, Wis., 107.
Ethylene gas—
effect on blanching of celery, N.J., 734.
effect on *respiration of ripening* bananas, 517.
effect on ripening of tomatoes, N.J., 734.
for artificial ripening of fruits, Mich., 424.
for ripening of fruits and vegetables, Minn., 38.
tests for control of storage scald, Ind., 337.
Eucalyptus regnans, lignocellulose determination, 808.
Eudemis vacciniana. (*See* Fireworm, black-headed.)
Eulia velutinana, notes, Va., 752.

Eulimneria crassifemur—
biology, 856.
notes, U.S.D.A., 57.
Euonymus japonicus, veined variegation in, cause, 542.
Eupelmus popa, studies, 254.
Euphorus helopeltidis, notes, 753.
Euphorus sahlbergellae, notes, 450.
Euplectrus platyhypenae, notes, Kans., 152.
Eupteryx auratus, transmission experiments with virus diseases, 651.
Eupteryx melissae, introduction and distribution, 249.
Euscelis—
obscurinervis, introduction and distribution, 249.
spp., notes, Mass., 846.
striatulus, notes, N.J., 751.
Eutettix tenella. (*See* Beet leafhopper.)
Euthrips pyri. (*See* Pear thrips.)
Euthrombidium sp., parasite of field cricket, U.S.D.A., 754.
Euxesta notata, notes, Calif., 350, 659.
Euxoa. (*See* Cutworms.)
Evaporation rate, determination, 276.
Evaporation studies in Sycamore Creek region of Indiana, 531.
Evergreens—
propagation, Va.Truck, 740.
sucking insect pests of, 753.
Evetria albicapitana, notes, Mich., 450.
Evolution and animal relationship, physiological evidences, 819.
Exanthema, control, Calif., 342.
Exeristes roborator, notes, U.S.D.A., 57.
Exoascus cerasi, notes, 654.
Exobasidiaceae, histological studies, 818.
Exochomus quadripustulatus, notes, Calif., 351.
Exorista achracea, parasite of codling moth, U.S.D.A., 453.
Exosmosis of dissolved substance from storage tissue into water, 212.
Experiment station—
and agricultural school of Nicaragua, plan for, 400.
work in the Transvaal, 799.
Experiment stations—
in Albania, notes, 500.
organization list, U.S.D.A., 290.
report, 96, 699.
report, editorial, 601.
(*See also* Alabama, Arizona, etc.)
Extension—
campaigns, planning and conducting, U.S.D.A., 87.
methods and relative effectiveness, U.S.D.A., 188.
methods, relative costs, U.S.D.A., 789.
teaching, papers on, 258.
work and rural church, U.S.D.A., 87.
work, cooperative, 1926, U.S.D.A., 189.
work, papers on, 258, 285.
Eyeworm, Manson's, of poultry, Fla., 876.
Fabrics—
penetration of ultra-violet rays, 698.
protective value, Kans., 196.
stiffness in, from different starches, U.S.D.A., 497.
(*See also* Textile.)
Fairy ring fungus, studies, Mass., 846.
Families, farm, village, and city, use of leisure time, Mich., 787.
Families, village and town, incomes and expenditures, Minn., 787.
(*See also* Farm families.)
Family living, relation to net cash receipts and expenditure, Ohio, 882.
Farm—
animals. (*See* Livestock *and* Animals.)
buildings and conveniences, Mich., 475.
buildings, fire-protective construction, U.S.D.A., 282.
buildings in India, design, 479.
credit. (*See* Agricultural credit.)
economy, effect of soil type, 283.
equipment, mechanical, research in, U.S.D.A., 78.
families, dietary studies, Wyo., 693.
families, food consumption, Ohio, 489, 585.
families of New York, sizes of purchasing centers, N.Y.Cornell, 86.
families in Utah, food habits, Utah, 87, 891.
families, relation to organizations, Wis., 188.
family, food consumption, Miss., 291.
family incomes and expenditures, Minn., 85.
fencing, studies, Calif., 376.
hired hands, perquisites and wages, U.S.D.A., 786.
home making, analysis of managerial responsibilities, U.S.D.A., 298.
home, use of time in, Nebr., 196.
income and taxation in North Carolina, N.C., 686.
income, papers on, 284, 285.
incomes, net, relation to weather surpluses, 285.
indebtedness, paper on, Mo., 883.
labor. (*See* Agricultural labor.)
land-selling prices, factors affecting, Calif., 80.
lands, stoning, Minn., 774.
life, issues, 579.
lighting, 881.
machinery. (*See* Agricultural machinery.)
organization and management, Ark., 580.
organization, effect of combines, Kans., 182.
organization in cotton belt, readjustment, 578.
ownership, trend in, 284.
population, age distribution, Ohio, 482.

Farm—Continued.
power and labor, Pa., 776.
prices, stabilization and the McNary-Haugen bill, 285.
products. (*See* Agricultural products.)
real estate price index, Mich., 286; Ohio, 683.
real estate situation, Mo., 883; U.S.D.A., 79.
real estate, tax valuation and sale price, Ohio, 481.
relief and permanent agriculture, 285.
relief, papers on, 284, 285.
structures, research in, 679.
supplies, distribution, services of rural trade centers in, Minn., 585.
supply, need for control, 284.
tenancy and lease forms, Pa., 286.
tenancy in Iowa, Iowa, 881.
timberlot management and utilization, Wis., 340.
timbers, preservative treatment, U.S.D.A., 679.
wiring, 880, 881.
wiring, treatise, 881.
Farmers—
American, foreign policy for, 285.
gross income, Iowa, 381.
immigrant, and their children, 687.
Farming—
dairy. (*See* Dairy farming.)
in North Dakota, types, U.S.D.A., 181.
part-time, research in, 283.
systems for Black Waxy Prairie Belt, Tex., 581.
systems in England, recent changes in, 884.
types in South Dakota, S.Dak., 782.
(*See also* Agriculture.)
Farms—
administration in groups, 578.
apple, economic study, Me., 183.
business analysis survey, Mich., 482.
California, enterprise efficiency studies, 288.
cash-rented, real estate tax and income to owner, Ohio, 482.
corn belt, organization, Ill., 684.
electricity on. (*See* Electricity.)
foreclosed, management, 883.
independent family, prospective displacement, 578.
irrigated, horse labor costs, Oreg., 684.
owner-operated, returns on capital, N.Mex., 284.
Fasciola hepatica—
development in final host, 872.
intermediate host of, 856.
notes, Oreg., 768.
Fat—
determination in substances high in fat, 310.
diets, high, muscular efficiency on, 693.
in diet, effect on growth of rats, 597.
metabolism in corn, effect of waxy gene, 22.
Fat—Continued.
necrosis in sheep, 69.
of beef cattle, melting point and refractive index number, Ga., 158.
Fats—
and oils, monograph, 610.
and oils, oxidation, destruction of vitamins by, 291.
progressive seasonal changes in plants, Mich., 424.
sparing action an antineuritic vitamin, 92.
translocation in germinating fatty seeds, 323.
vitamin-A containing, fluorescence measurement, 292.
(*See also* Oils.)
Fat-soluble A. (*See* Vitamin A.)
Fatty—
acids of palm oils, composition, 802.
foods, relation to public health, 390.
seeds, germinating, translocation of fats, 323.
substances, moisture and crude fat determination in, 310.
Fauna of Germany: Diptera, 55.
Feather mite, control, 546.
Feather mite in Ohio, Ohio, 456.
Feathers, hydrolized, as feed for chickens, Kans., 164.
Federal Farm Board bill, paper on, 285.
Feed grinders, types, Oreg., 75.
Feed stores, retail, economic study, N.Y.Cornell, 287.
Feeding experiments. (*See* Cows, Pigs, *etc.*)
Feeding stuffs—
energy, utilization in growth of pigs, Ill., 461.
green, motor-driven chopper for, Oreg., 79.
grinders for, Ind., 376.
grinding, electric motors for, Pa., 880.
grinding for dairy cattle, Ind., 368.
inspection and analyses, Conn.State, 558; Mass., 59; N.H., 59; R.I., 558; Tex., 158; Vt., 59, 758.
investigation and valuation in German experiment stations, 610.
special-purpose mixed, approved formulas for, Tex., 258.
Feijoa fruit decays, notes, 245.
Felita segetum parasites, biology, 354.
Fence posts—
cement concrete, design and manufacture, 280.
preservative treatment, U.S.D.A., 679.
studies, Calif., 378.
Fermentation research, results, Wis., 107.
Ferns, field book, 580.
Fertility—
for vegetable production, maintenance, Md., 622.
in animals, factors affecting, 821.
studies, Ind., 829.

Fertilizer—
experiments, Ind., 319; Iowa, 318; Kans., 116; N.J., 715; Oreg., 20.
(*See also* special crops.)
field tests, value after Neubauer analyses, 813.
materials and mixtures, hygroscopicity, 813.
materials, prices, N.Y.Cornell, 210.
mixtures, computation, 812.
ratio experiments, Ga., 118.
tonnage, factors affecting, N.Y.Cornell, 210.
triangle, use, 812.
Fertilizers—
analyses, Ky., 120; N.J., 21; Vt., 21.
analyses and guaranties, Mo., 815; S.C., 815.
and soils, studies, R.I., 614.
concentrated, effect on crops in soils of varying composition, N.J., 715.
economic significance, 285.
effect on nitrate in sap, Mich., 717.
effect on pastures, Conn.Storrs, 431.
effect on quality and yield of crops, Utah, 20.
for different crops and soils, Ind., 210.
from sewage sludge, 210.
inspection, Mass., 20.
inspection and analyses, N.H., 120; N.J., 211.
investigation and valuation in German experiment stations, 610.
methods of application, Iowa, 818.
nitrogenous. (*See* Nitrogenous fertilizers.)
registrations, N.J., 211.
Fiber, crude. (*See* Cellulose.)
Field—
crop enterprises, southern, textbook, 290.
crops, Russian, in United States, 327.
crops under irrigation, experiments, U.S.D.A., 724.
crops work in India, 518.
(*See also* Crops, Forage crops, Root crops, etc.)
experiments with Illinois soils, Ill., 423.
plat tests, experimental error in, 327.
Figs—
acids in, 804.
chromosomal variations in, Calif., 326.
endosepsis, control, Calif., 841.
Green Ischia, notes, Miss., 438.
hardiness and pruning, studies, Calif., 336.
nomenclature, Calif., 836.
starch cycle in, Calif., 336.
thrips as carriers of fig-decaying organisms on, 659.
Filaria worm, relation to fistulous withers in horses, Kans., 173.
Fir, balsam, as source of pulpwood, Mich., 740.
Fir, fruit cast, studies, 349.
Fire blight organism, overwintering and modes of infection, Mich., 448.
Fire blight, studies, Wis., 148.
Fire hazards in farm buildings, remedies, U.S.D.A., 282.
Fires, forest. (*See* Forest fires.)
Fires in cotton gins, cause and prevention, U.S.D.A., 479.
Fireworm, black-headed, on cranberry, Mass., 850.
Fish meal—
effect on flavor or odor of pork, Ga., 162.
feeding value, 862; N.J., 762; W.Va., 163.
substitutes for fattening pigs, 665.
v. tankage as protein supplements, Ga., 161.
Fish, New Zealand, food values, 692.
Fish oil as adhesive in sprays, 248; U.S.D.A., 356.
Flax—
breeding experiments, 29, 825; Oreg., 26.
dry land culture, U.S.D.A., 724.
fiber, effect of potassium, Oreg., 20.
husks, feeding value, 867.
seeding experiments, Oreg., 26.
variety tests, N.Dak., 726; Oreg., 26.
Flaxseed, effect on milk, N.J., 765.
Flea beetle, black, insecticides tested against, Ind., 353.
Flea beetles—
on cruciferae, biology, 354.
pale-striped and banded, notes, Va., 758.
Fleeces of breeding sheep, method of judging, Calif., 260.
Flies—
house. (*See* House flies.)
reared in laboratory, apparatus and methods, 848.
white. (*See* White fly.)
Flood silt soils, characteristics, N.H., 116.
Flora of Philippines, introduced cultivated element, relation to insects, 753.
(*See also* Plants and Vegetation.)
Florida Station, notes, 198, 499.
Flour—
baking quality relation to pH, 586.
baking tests, Ind., 386.
chemistry, studies, Kans., 107.
diastatic activity in, determination, 808.
leguminous, new kinds, 88.
moth, Mediterranean, biology, 254.
pH determination, 807.
quality, factors affecting, Kans., 190.
Wyoming, baking studies, Wyo., 192.
(*See also* Bread.)
Flower gardens—
fungus disease affecting, 347.
insects of, control, 450.
Flowers—
cell sap of, pH value, 720.
fertilizer studies, Ohio, 439.

Flowers—Continued.
for Panhandle country, Okla.Panhandle, 442.
response to temperature, 837.
(*See also* Plants, ornamental.)
Fluorine in dairy cattle ration, effect, Mich., 65.
Fly repellents for dairy cattle, use, Kans., 168.
Fodder crops. (*See* Forage crops.)
Fomes spp., notes, U.S.D.A., 143.
Food—
consumption, effect on growth of animals, 893.
consumption of a farm family, Miss., 291.
consumption of farm families, Ohio, 489, 585.
Drug, and Insecticide Administration, U.S.D.A., 712.
fats, requirements for health, 390.
habits for children, U.S.D.A., 490.
habits of Utah farm families, Utah, 87, 891.
materials, aluminum in, detection, Mich., 712.
nutrition, and health, handbook, 87.
of Japan, 88.
products, irradiating on commercial scale, feasibility, Wis., 195.
storage, in plant cells, 23.
(*See also* Diet.)
Foods—
analyses, Conn.State, 890.
analyses, treatise, 609.
canned. (*See* Canned foods.)
Chinese, calcium, iron, and magnesium in, 589.
eaten in college community, energy and protein content, N.H., 890.
Georgia, vitamin content, Ga., 193.
inspection, Me., 693.
irradiated, antirachitic properties, effect of superheating, 596.
manganese in, 590.
nutritive values graphically expressed, 87.
oriental, analyses, 586.
oriental, vitamin A in, 592.
oriental, vitamin G in, 894.
sulfur dioxide in, determination, 312.
vegetable, zinc in, 888.
Foot-and-mouth disease—
disinfectants for, 470.
immunization, 471.
studies, 470.
virus, plurality, 470.
virus, types, complement fixation method for determining, 268.
virus, viability, effect of ultra-violet light, 568.
Foot rot in sheep, cause, 571.
Forage—
crop diseases, studies, Kans., 144.
crops, distribution in Oklahoma, 330.
crops for pigs, Nebr., 860; Ohio, 463.
crops, tests, Utah, 27.
Forage—Continued.
drought resistant, 59.
feeds of range cattle, phosphorus deficiency in, 58.
grasses, variety tests, Hawaii, 723.
mixtures, variety tests, N.Mex., 219.
poisoning. (*See* Livestock poisoning, Plants, poisonous, *and specific plants*.)
production in Wales, 518.
Forest—
administration. (*See* Forestry.)
biology, need for standardized methods, 530.
destruction, economic aspects, U.S.D.A., 143.
entomology, principles, treatise, 355.
fire prevention handbook, U.S.D.A., 86.
fires, notes, Ohio, 443.
fires, relation to weather conditions, Wis., 142.
growth and swamps, drainage, Wis., 646.
growth, seedlings and sprouts, value, Mich., 838.
insects of India, 850.
litter, effect on soil temperature and soil freezing, 647.
management, proposed, U.S.D.A., 144.
plantations, Iowa, 340.
planting stock, development and survival, 142.
resources of southeastern Alaska, U.S.D.A., 42.
seeding experiments in Rocky Mountains, 42.
stand tables, constructing, alinement charts in, 285.
trees. (*See* Trees.)
types in Knysna region, 42.
Forestry—
and forest resources of Western Australia, 531.
and forests in Oregon, 531.
and the agricultural crisis, 284.
clubs for young people, U.S.D.A., 385.
in Minnesota, 839.
in New England, research in, 283.
practices, Dunbar Station studies, Mich., 42.
studies, Kans., 141; Mich., 442; N.H., 142; Ohio, 442; Wis., 142.
Forests and forestry in Oregon, 531.
Forests of western United States, 41.
Formaldehyde—
effect on anthrax spores on skins, 71.
gas for *Salmonella pullorum* in incubators, 874.
tolerance of calves for, Ohio, 466.
Formic acid—
in acetic acid, determination, 109.
theory of photosynthesis, 625.
Formica rufa, biology, 753.
Foulbrood, American—
field treatment, Kans., 157.
on brood combs, sterilization, Wyo., 663.

Fowl cholera—
bacillus, disinfectants for, 470.
immunisation, method, 875.
organism, viability relation to soil reaction, N.J., 769.
studies, Kans., 172, 173.
Fowl mite, tropical, in Ohio, Ohio, 456.
Fowl paralysis—
autopsy findings, 876.
in South Africa, 474.
studies, R.I., 676.
Fowl pest virus, studies, 372, 870.
Fowl plague virus mixture with immune serum, dilution phenomenon, 474.
Fowl pox—
control, West.Wash., 572.
immunization, 274, 876; Idaho, 874; Ohio, 473; R.I., 676.
skin vaccination for, N.H., 176.
summary, N.J., 573.
transmission by mosquitoes, 274.
vaccine, results, Calif., 370.
Fowl typhoid—
control, Calif., 370.
immunization, N.C., 770.
in South Africa, 375.
resistance, breeding for, Iowa, 375.
summary, 275.
Fowls—
color factors in, behavior, 821.
parasitic intestinal diseases, experimental treatment, 876.
preferential mating, 64.
(*See also* Chickens, Hens, Poultry, *etc.*)
Fowl's ureters, function, 374.
Foxes, diseases of, 848; Wis., 173.
Foxes, silver, raising, Can., 669.
Frankliniella—
occidentalis on apples, notes, Oreg., 53.
sp. on figs, 659.
Freezing of soil, effect of forest litter, 647.
Frost and frost damage prevention, U.S.D.A., 228.
Frost protectors, tests, Mich., 424.
Fruit—
breeding, S.Dak., 39.
crop destroyed by low temperatures, N.Mex., 228.
flies, larvae and pupae, characters, 357.
flies, possible serious pests in California, identification, Calif., 659.
fly, Mediterranean, in Florida, 659, 854, 855.
fly, Mediterranean, paper on, 657.
fly, Mediterranean, summary, 659.
insects in 1928, Conn.State, 547.
jellies, rôle of pectin in, Del., 610.
June drop, relation to leaf surface of secondary shoots, Ohio, 439.
moth, oriental. (*See* Peach moth, oriental.)
products, experiments, Calif., 387.
regions and varieties of eastern New York, N.Y.State, 340.
Fruit—Continued.
spot, control, 645.
stocks, seedling, production, 229.
stocks, seedling, studies, N.Y.State, 524.
stocks, studies, Iowa, 338.
tree chlorosis, lime-induced, treatment, 243.
tree leaf roller, control, Calif., 351; Idaho, 848.
tree leaf roller, summary, N.Y.State, 155.
trees, effect of straw mulch., Okla. Panhandle, 525.
trees, mites infesting, 354.
trees, rodent injury, Ohio, 836.
trees, winter injury, Oreg., 36.
Fruits—
and vegetables, marketing, treatise, 584.
artificial ripening, Minn., 38.
as an adjunct to farms, 884.
citrus. (*See* Citrus fruits.)
composition, U.S.D.A., 89.
decay in storage, control, Oreg., 50.
dried, insects affecting, 850.
dried, sulfur dioxide in, 312.
fruitfulness in, 526.
Hawaiian, preservation, Hawaii, 790.
incompatibility and sterility in, 428.
new, in Ontario, 527.
notes, Miss., 439.
oriental, vitamin C in, 595.
packed in cold storage rooms and cars, temperature studies, Calif., 376.
phenological data, N.J., 733.
pollination studies, Mich., 230.
production in South Africa, 229.
refrigeration, in transit, Ill., 836.
setting, Okla.Panhandle, 441.
shipping, containers used in, U.S.D.A., 339.
small, chromosome number, effect on berry size, 427.
small, varieties, N.Y.State, 340.
small, variety tests, Kans., 138.
small, winter injury, R.I., 640.
spray removal from, Oreg., 35.
spray schedules for, Kans., 141.
station seedlings, value, Iowa, 338.
stone, sour sap and gummosis, Calif., 342.
storage, physiological aspects, 528.
studies, Hawaii, 732.
tropical, ripening with ethylene gas, Minn., 39.
varietal and cultural tests, N.Dak., 735.
varieties, Ohio, 527.
variety tests, Oreg., 36.
(*See also* Orchards, Apples, Peaches, *etc.*)
Fuels for cooking in rural homes, Ind., 394.
Fumigants, maximum weights in vapor form in inclosed space, 545.

Fungi—
comparative morphology, treatise, 513.
effect on nitrogen in soil, Wis., 115.
microphotographic atlas, 720.
parasitic, in greenhouse soils, eradication, Mass., 840.
plant disease, racial specialization, lecture on, 741.
sexuality in, 818.
species, differentiation, Mich., 443.
structure and development, 513.
symbiotic, of cereal seeds, relation to proteins, 22.
wood-destroying, on fallen trees, U.S.D.A., 143.
wood-*destroying, studies, 343, 542.*
Fungicides—
analyses, Me., 228.
composition, Conn.State, 355.
(See also Sprays *and specific kinds.)*
Fungus disease of flower gardens, 347.
Fur-bearing animals of Alaska, laws and regulations, U.S.D.A., 542.
Furnaces, warm-air, studies, 577.
Fusarium—
batatatis, control, N.C., 745.
batatatis, varietal resistance to, N.C., 744.
cubense, notes, 648.
lini, nutritional studies, 47.
lycopersici, notes, N.J.,742.
oxysporum medicaginis, notes, Kans., 145.
oxysporum, notes, N.C., 745.
sp., differentiation, Mich., 443.
sp., notes, Mass., 840; Mich., 444.
sp. on corn, control, Calif., 344.
spp. on potatoes, 538.
vasinfectum, studies, 650.
Fusarium—
disease of cotton, 345, 536.
hyphae, outer covering, composition, Ohio, 445.
problem, lecture on, 741.
wilt of tomato, description, Va.Truck, 746.
Fusicladium—
dendriticum. (*See* Apple scab.)
eriobotryae, notes, 841.
pirinum, notes, 841.
saliciperdum, studies, Conn.State, 349.
Fusicoccum putrefaciens, notes, 244
Galba bulimoides, intermediate host of fluke, 856.
Galerucella luteola. (*See* Elm leaf beetle.)
Galvanometer mounting, jar proof, 12.
Game animals, life history and habits, 748.
Game of Alaska, laws and regulations, U.S.D.A., 542.
Gapeworm, new species, from robins, 574.
Garden—
crops. (*See* Vegetables *and specific crops.)*
irrigation, method, Okla.Panhandle, 177.
pests, recognition and control, 855.
Garden—Continued.
slug, gray, control, Calif., 352.
tractors, studies, Mich., 78.
Gardenia bud drop, report, 246.
Gardening in southeastern United States, treatise, 522.
Gardens, vegetable, planning, planting, and care, Iowa, 339.
Gas-compression system, high-pressure, U.S.D.A., 78.
Gastrocystis gilruthi, notes, 272.
Gelatin—
addition to Cheddar cheese, Idaho, 869.
commercial, effect on growth of young pigs, N.J., 651.
membranes, permeability, 120.
nutritive properties, 89.
oleate mixtures, use for demonstration of small amounts of calcium, 711.
samples, comparison, 567.
swelling and electrical charge, effect on H-ion adsorption, 502.
Gelechia gossypiella. (*See* Bollworm, pink.)
Gene, concept of, papers on, 215.
Genes for short-ear and density in mice, cross-over between, 820.
Genes, nature of, and transmutations, 820.
Genetic equilibrium and selection, 122.
Geology of southeastern Montana, 773.
Geology of upper McKenzie Valley, Oregon, 773.
Georgia Station, notes, 97, 198, 598.
Georgia Station, report, 197.
Geranium, effects on Japanese beetle, 555.
Germanin and Naganol, comparison for trypanosomal and spirochetal infection, 569.
Germanium added to iron, effect on blood regeneration, 590.
Ghee adulteration with animal fat, detection, 503.
Gibberella saubinetii, notes, Wis., 148, 149.
Ginger tests, Hawaii, 723.
Gipsy moth—
control in New Jersey, 550.
larvae, disease of, 546.
work in Connecticut, Conn.State, 547.
Girls' strawberry club, manual, Ill., 489.
Gizzard worms in poultry, Kans., 172.
Gladiolus—
breaking rest period, Mass., 832.
corms, planting date in Florida, R.I., 640.
hard rot, corm treatments for control, N.J., 743.
scab, control, Miss., 446.
varieties, Ohio, 645.
Glass—
substitute, Cel-O-Glass as medium for ultra-violet radiation of chicks, N.J., 768.
substitute, Vitaglass, for rickets prevention, 94.
substitutes, value for transmitting sunlight to chicks, Wis., 165.

Glass—Continued.
ultra-violet transmitting, effect on Digitalis, 628.
ultra-violet transmitting, types, 795.
Globidium gilruthi, development, 272.
Gloeosporium blight of raspberry, 348.
Gloeosporium—
kiotoense n.sp., description, 647.
musarum, notes, 654.
perennans, notes, Oreg., 49.
perennans, relation to woolly aphids, Oreg., 540.
Glucose—
adsorption by fuller's earth and norit, 12.
determination, 13, 109, 311.
oxidation by alkaline copper solutions in presence of boric acid, 415.
Glucosides, cyanogenetic, behavior in cherry-laurel during starvation, 818.
Glutelins of rye and barley, 801.
Glycocoll oxidation by alkaline copper solutions in presence of boric acid, 415.
Glyptocelis squamulata control, Calif., 350.
Gnomonia erythrostoma, notes, 348.
Goat grass, eradication, 227.
Goat grass, notes, Calif., 328.
Goat Society, British, yearbook, 859.
Goats—
clearing brush land with, Oreg., 60.
experiments at Beltsville farm, summary, U.S.D.A., 457.
foot rot in, treatments, Oreg., 68.
milk, improvement, N.Mex., 263.
parasitic diseases, Oreg., 68.
water consumption, Oreg., 60.
worm parasites, treatment for, Oreg., 768.
Goiter—
and iodine treatment, 590.
relation to iodine in Maryland waters, 393.
Golden spider beetle, notes, Mont., 153.
Goldenglow borer, studies, Mich., 57.
Goniobasis plicifera silicula, notes, Oreg., 69.
Gooseberries—
culture, N.Y.State, 644.
spray removal from, Oreg., 35.
Gooseberry—
borer, life history and control, Oreg., 52.
fruit worm, notes, Utah, 54.
Gossypium, genetics and physiology, 817.
Gossypol, Carruth's D, nature of, 9.
Gossypol, studies, 9, 802.
Gourds for bird houses and other purposes, U.S.D.A., 449.
Gracilaria syringella, morphology and biology, 550.
Graft unions, defective in pear and apple, Mich., 525.
Grafts and buds, new wrapping material for, 229.
Grain—
and chopped roughage, mixed v. unmixed, Ohio, 457.
breeding experiments, 29.
costs, N.H., 180.
cleaning machines, recent developments in, 683.
crops in western Washington, West. Wash., 29.
drying tests, Ind., 377.
fineness of grinding for pigs, Oreg., 61.
marketing, Illinois, seasonal features, Ill., 484.
marketing, place of future trading in, 688.
seed, winnowing by air blasts, sorting phenomena, 478.
smuts. (*See* Cereal smuts *and specific grains.*)
storage tests, Iowa, 329.
transportation charges in United States and Canada, 287.
Grains—
and roughage, mixing for cows, Ohio, 465.
dipterous larvae attacking, 354.
minerals in, Utah, 409.
variety tests, N.C., 725.
(*See also* Cereals *and* Oats, Rye, Wheat, *etc.*)
Gramineae, dipterous larvae attacking, 354.
Granary weevil, biological studies, 758.
Grape—
berry moth, infestation, relation to snow cover, 253.
berry moth in Delaware, life history and control, 253.
industry in California, 885.
juice studies, Calif., 887.
roots, *Margarodes vitium* on, 250.
sawfly, life history and habits, 856.
sclerosis, notes, 50.
Grapefruit—
culture in British Colonies, 529.
effect of freezing temperature, Miss., 438.
gummosis, studies, Calif., 341.
heat requirements, Calif., 336.
propagation studies, Calif., 335.
Grapes—
berry thinning, 644.
breeding experiments, Calif., 336.
California, effect of bud position on clusters, 836.
California, marketing, 885.
chromosome number in, 24, 517.
Concord, pruning and fruiting studies, 644.
culture and varieties in California, 528.
culture in New York, N.Y.State, 141.
duty of water project, N.Mex., 228.
fertilizer experiments, Mass., 833.
girdling experiments, Calif., 337.

Grapes—Continued.
girdling experiments with seedless varieties, 645.
growth and fruit production, studies, 644.
in warehouse precoolers, tests, Calif., 335.
Kachetien, assimilation and transpiration, 816.
pruning and mulching, Nebr., 833.
pruning experiments, Calif., 336; Mass., 833.
pruning systems, Kans., 138; Mo., 141.
quality in, 528.
scientific research in Europe, 528.
treatment for shipment or storage, Calif., 739.
varieties, N.Y.State, 340.
variety tests, Miss., 438.
winter injury, R.I., 640.
yield, relation to growth, Kans., 138.
(*See also* Vineyards.)
Grapevine apoplexy, notes, 50.
Grapevines—
early training requirements, Md., 831.
sulfuring and spraying, 349.
Graphite, structure, 801.
Grass—
and clover seed mixtures, principles of compounding, 227.
clippings, dried, value for poultry, Idaho, 861.
feeding value for lambs, Ind., 362.
Grasserie of silkworms, studies, 55.
Grasses—
behavior in seeding year, 29.
distribution in Oklahoma, 330.
drought resistant, studies, N.Mex., 220.
fertilizer experiments, Kans., 125.
forage, varieties, Oreg., 26.
fungus parasites of, Mass., 840.
Helminthosporium giganteum on, 746.
irrigated pasture, manuring experiments, Kans., 126.
lawn, fertilizer experiments, R.I., 825.
lawn, variety tests, Kans., 125.
nationality and strain tests, 518.
notes, Ga., 125.
pasture, notes, Miss., 433.
studies, Calif., 327.
turf, studies, N.J., 725.
variety tests, Idaho, 823; Tenn., 127.
weedy, injurious to livestock, Iowa, 873.
(*See also* Grassland, Pastures, *etc.*)
Grasshoppers—
affecting tobacco, control, Wis., 154.
and locusts, handbook, 54.
notes, S.Dak., 53.
poison bait for, Mich., 450.
Grassland management, intensive system, 257.
Grasslands of New Zealand, reseeding experiments, 632.
(*See also* Grasses and Pastures.)
Green bug, notes, Mich., 450.
Green manure crops—
leguminous and nonleguminous, tests, N.J., 715.
tests, R.I., 614.
Greenhouse centipede, losses from and control, Ind., 353.
Greenhouses, fumigation, N.Y.Cornell, 155.
Ground hogs, protection of fruit trees from, Ohio, 836.
Grouse locust, inheritance studies, Kans., 123.
Growth and salt concentration, 213.
Growth, rate, relation to diet, 291.
Guar as cover crop, Calif., 328.
Guava juice, canned, use, Hawaii, 790.
Guggenheim Fellowships in Agricultural Science, notes, 99.
Guinea grass and sorghum silage, comparison, 558.
Guinea pigs—
color factors, effects in combination, 218.
inbred families, persistence of differentiation, U.S.D.A., 218.
litter, size, weights, and mortality, relation, 257.
Gums for making oil emulsions, tests, N.J., 751.
Gymnopleurus sinnatus, intermediate host of *Spirocerca sanguinolenta*, 676.
Gymnosporangium spp. on apples, N.Y.Cornell, 150.
Gymnosporium juniperi-virginiana, notes, Mich., 449.
Gypsum, effect on corn yields, Oreg., 26.
Haemonchus contortus, notes, 374.
Haltica foliacea, control, Kans., 152.
Hardwood resources in Louisiana, 838.
Harlequin bug, control, N.C., 752.
Harmolita spp., notes, Utah, 54.
Harmostomum hawaiiensis n.sp., description, 573.
Hawaii Station, notes, 198.
Hawaii Station, report, 796.
Hawaii University, notes, 198, 499.
Hawaiian Pineapple Canners' Station, notes, 499.
Hay—
and straw, blowing stackers for, studies, 478.
chopping for horses, value, Wis., 163.
composition, factors affecting, 30.
crops, comparisons, N.J., 724.
curing, studies, Mich., 482.
drying tests, Ind., 377.
feeding value for milking cows, 262.
fertilizer experiments, Ind., 829; Miss., 436; Va., 727.
ground, for milk production, S.C., 66.
harvesting, methods, Idaho, 877.
hoisting by electricity, Oreg., 75.
lands, fertilizer experiments, N.H., 126.
production, cost and efficiency, Oreg., 685.
v. pasture grass, nutritive value, 857.

Hay—Continued.
(*See also* Grasses, *and* Alfalfa, Timothy, *etc.*)
Health, rural, and sanitation, 579.
Heartwater of cattle, sheep, and goats, summary, 568.
Heat. (*See* Temperature.)
Heating systems, studies, 577.
Heifers—
beef, wintering, Va., 758.
costs of production, Wis., 181.
feeding experiments, Kans., 167; Okla.Panhandle, 66.
growth, factors affecting, 561.
mineral requirements, Oreg., 65.
raising, W.Va., 67.
winter, closed shed v. open shed for, Ind., 368.
Heleria rubidella in orchards in Wenatchee district, 246.
Heliothis obsoleta. (*See* Bollworm *and* Corn earworm.)
Heliothrips—
fasciatus on pears, 249.
femoralis, control, 546.
rubrocincta, notes, 450.
Helminth proteins, hypersensitiveness to, 174.
Helminthology manual, 372.
Helminthosporium diseases of rice in Pacific regions, 539.
Helminthosporium—
giganteum on grasses, 746.
sativum, notes, 649.
sativum, studies, Kans., 145.
Helminths, action on hosts, 71.
Helopeltis bergrothi in Nyasaland, 658.
Helopeltis theivora, notes, 753.
Hematuria of native cattle in Formosa, 570.
Hemerobius sp., notes, 549.
Hemlock, fruit cast, studies, 349.
Hemlock, light requirements, 42.
Hemoglobin—
concentration of nursing rats, effect of maternal diet, 792.
muscle, effect of diet, 392.
production, copper as supplement to iron, Wis., 193.
production in rats, relation to diet proteins and vitamins, 198.
production, manganese as factor, 90.
production, manganese-copper-iron complex as factor, 791.
regeneration in albino rats, effect of whole wheat, 589.
Hemp—
breeding experiments, 29.
manila. (*See* Abaca.)
stems, morphological and microscopic studies, 826.
Hendersonia mali, perfect stage, 653.
Henicospilus parasite, biological studies, 557.
Hens—
cock-feathered laying, studies, 630.
Hens—Continued.
laying, causes of mortality, Mich., 73.
laying, effect of confinement, Ohio, 868.
laying, effect of feeding hydrolized feathers, Kans., 164.
laying, effect of poultry house ventilation and temperature, 258.
laying, feeding experiments, 862.
laying, rations for, Iowa, 367.
(*See also* Egg production.)
White Leghorn, characteristics, W.Va., 165, 863.
Hepatitis, infectious necrotic, in Australia, 378.
Herd improvement with foundation cow, Mich., 498.
Heredity—
and bean anthracnose, 843.
and reproduction, studies, Kans., 123.
in a wheat cross, 723.
in albino cattle, Wis., 123.
in barley, analysis, 629.
in cotton crosses, 629.
in grouse locust, Kans., 123.
in lettuce, 429.
in peaches, N.J., 733.
in plants, experiments, S.Dak., 517.
in poultry, studies, Kans., 123.
in sheep and swine, Ohio, 430.
in twins, 518.
in wheat crosses, 216.
of butterfat production, mode, Mo., 169.
of chalk-face in Merino sheep, 257.
of claw fingers, 820.
of correlated characters in barley, 721.
of egg weight, R.I., 821.
of egg weight in fowls, 826.
of human skeletal anomalies, 630.
of kernel arrangement in sweet corn, Ill., 25.
of left-handedness, 820.
of pigments in killifish, 820.
of pubescence in soybeans, 723.
of resistance to hog cholera, 257.
of sorghum tassel in corn, 122.
of ticking factor in hounds, 820.
Hessian fly—
and the Illinois wheat crop, 254.
infestation of wheat in 1929, Ohio, 849.
notes, Iowa, 353.
status in Kansas, Kans., 152.
Heterakis—
papillosa in poultry, Kans., 172.
papillosa, life cycle studies, 578.
vesicularis, development, 678.
Heterodera—
radicicola, notes, N.C., 447.
schachtii, control, 542.
Heteroligus claudius, notes, 450.
Heterosis in *Phaseolus vulgaris*, 630.
Heterosporium gracile on iris, resistance to, 841.
Heterothallism in *Ustilago zeae*, 533.

Heterozygotes, detection with X-rays, 819
Hevea brasiliensis. (*See* Rubber.)
Hickory, Appalachian, quality, 277.
Hickory leaf gall midges, 546.
Highway traffic analysis methods and results, U.S.D.A., 177.
Highways. (*See* Roads.)
Hippodamia convergens, notes, 549.
Histidine, ergothioneine as substitute, 90.
Hog cholera—
control in Maryland, 571.
immunity, studies, Kans., 172.
in baby pigs, Kans., 172.
resistance, breeding for, Iowa, 874.
selection for natural resistance, 257.
vaccine, notes, Calif., 370.
virus, properties, 675.
Hogs. (*See* Pigs.)
Holcocera iceryaeella, notes, Calif., 351.
Holcocera maligemmella, notes, Mich., 450.
Holly mite, life history, Mass., 850.
Hollyhock rust, control, Ind., 342.
Home—
demonstration work under Smith-Lever Act, 1914–1924, U.S.D.A., 789.
economics teacher training under Smith-Hughes Act, 691.
grounds, summer care and maintenance, Okla.Panhandle, 530.
making courses, textbook for, 691.
making on the farm, analysis of managerial responsibilities, U.S.D.A., 298.
Homoptera in Palestine, 356.
Honey production at Ottawa, Can., 455.
Honey, vitamin E in, 597.
Hookworms, proteins of, cutaneous tests with, 174.
Hop downy mildew in England in 1927, 537.
Hop powdery mildew, control, 648.
Hoplocerambyx spinicornis—
epidemic attacks, 757.
studies, 255.
Hormones, wound, in plants, 514.
Horseradish bacterial leaf spot, description, 240.
Horses—
breeding diseases, 73.
draft, feeding experiments, Iowa, 364.
effect of deficient rations on spermatozoa, Calif., 364.
fatal disease of, nature and cause, Nebr., 768, 869.
fistulous withers and other lesions due to *Brucella abortus*, 472.
fistulous withers in, relation to filaria worm, Kans., 173.
labor costs on farms, Oreg., 684.
pasture values and pasture methods, Kans., 158.
relation between conformation and pulling ability, 258.
semen, pH value, 821.
stabling, feeding, and care, treatise, 666.
Horticultural—
Congress, International, notes, 100.
possibilities of Palestine, 381.
research institutions, European, 834.
Horticulture—
Arthur H. Scott Foundation at Swarthmore College, notes, 500.
enterprises, textbook, 290.
in Manchuria, climatic conditions, 522.
treatise, 227.
Hotbeds and coldframes, construction and management, N.Mex., 37.
House flies, fumigation for, S.C., 452.
Humic substances in wood decomposition, 720.
Humidity—
as factor in control of leaf diseases, Ohio, 444.
effect on milk production, N.J., 765.
Huntley Field Station, work, U.S.D.A., 797.
Hyalomma mauritanicum, transmission of theileriosis by, 175.
Hyalopterus arundinis. (*See* Plum aphid, mealy.)
Hybridization in Ribes, 429.
(*See also* Plant breeding *and specific plants*.)
Hybrids, reciprocal, paper on, 215.
Hydatid disease in Australia, control, 267.
Hydriodic acid, boiling, action on gossypol, 802.
Hydrocarbons, pure, knock ratings, 379.
Hydrocyanic acid—
gas concentration, determination, 546.
gas, maximum weights in inclosed space, 545.
toxicity, 656.
Hydroecia micacea as hop pest, 354.
Hydroferrocyanic acid, manganometric determination, 501.
Hydrogen—
cyanide, penetration into living cells, 121.
electrode vessels, Clark, shaker for, 12.
ion concentration, determination, method, 309.
ion concentration, monograph, 610.
ions, adsorption, effect on gelatin, 502.
Hydrophobia. (*See* Rabies.)
Hylemyia—
antiqua, control, 544.
antiqua, status in Wisconsin, 554.
brassicae, biology and ecology, 354.
brassicae, control, 544.
cilicrura. (*See* Seedcorn maggot.)
Hylurgops glabratus, studies, 557.
Hymenolepis carioca, intermediate host of, 455.
Hypervitaminosis and vitamin balance, 297.
Hyphantria cunea. (*See* Webworm, fall.)
Hypochnus rot of apples, notes, 244.
Hypoderma bovis. (*See* Cattle grubs.)
Hypoderma lineatum. (*See* Cattle grubs.)
Hypoglycemia in nursing young, 696, 697.

Ice cream—
bacterial count at freezing temperatures, 566.
bacteriological study, Kans., 171.
from high heat treated dried skim milk, 869.
improvers, enzyme activity, Ill., 869.
inspection, Me., 693.
irradiated, antirachitic value, N.J., 767.
making, principles, Nebr., 869.
manufacture and distribution, abstracts of literature, 267.
mix, overrun produced under reduced air pressure, Mich., 468.
mix, properties, effect of salts, 565.
mix, reducing to its basic viscosity, device, 869.
mix, viscosity in, N.H., 171, 767.
plant-packed, lowering weight-texture handicaps, 566.
quality, relation to surface tension, Wis., 171.
studies, Ind., 368.
value of egg yolk in, Kans., 171.
vanilla in, effect of storage, Mich., 67.
Ice house experiments, Iowa, 877.
Ichneumon flies of North America, revision, 758.
Ichneumonid fauna of South Ussuri region, 354.
Idaho—
Station, free publications available, 898.
Station, notes, 198.
Station, report, 898.
University, notes, 198.
Idiocerus spp., introduction and distribution, 249.
Immigrant communities, case studies, 687.
Impact reaction, effect of wheel type, U.S.D.A., 775.
Incomes and expenditures of village and town families, Minn., 787.
Incubation—
and brooding, electric, Wash.Col., 379.
artificial, Ariz., 560.
of eggs, effect of turning, S.Dak., 63.
Index numbers of production, wages, and prices, Ohio, 181, 482, 684, 883.
Indian meal moth on dried fruit, 850.
Indiana Station, notes, 895.
Indiana Station, report, 394.
Indicators—
acid-base, activity coefficients, 805.
new reversible oxydimetric, 501.
Indigofera sumatrana as cover crop for palms, 529.
Industries in United States, recent migrations, 285.
Infants—
breast fed and artificially fed, later development, 888.
effect of high cereal diet, 892.
fed artificially, calcium and phosphorus metabolism, 496.
Infants—Continued.
feeding, acid milk v. sweet milk in, 892.
feeding, acidified milk for, Wis., 191.
feeding, breast v. artificial feeding, 790.
feeding, certified v. pasteurized milk in, 587.
feeding, dried whole milk for, 587.
feeding formulas, preparation, 588.
feeding in China, sources of vitamin C, 193.
feeding, routine use of vitamin B factor, 593.
feeding, vitamin content of milk for, 493.
vitamin B deficiency in, 293.
(*See also* Children.)
Inheritance. (*See* Heredity.)
Insect—
beneficial, introduction into Egypt, 657.
metabolism, effects of variable v. constant temperatures, apparatus for study, 655.
survey of Ohio wheat fields, Ohio, 849.
Insecticide administration, organization, U.S.D.A., 712.
Insecticides—
analyses, Me., 228.
and insects in England, 354.
composition, Conn.State, 355.
contact, penetration and toxicity, N.H., 154.
tests, Mass., 848; N.J., 751; Oreg., 58.
tests for codling moth, Kans., 153.
(*See also* Sprays *and specific forms.*)
Insects—
affecting fruits, control, 355.
affecting poultry, control, Nebr., 175.
and insecticides in England, 354.
and men, foibles of, treatise, 51.
and pests in Denmark, 547.
and pests in France, 547.
arsenical tolerance, 354.
beneficial, introduction into California, Calif., 351.
chemical senses, 546.
collecting vial for, 246.
control, dust v. liquid sprays, 354.
control, handbook, 848.
economic, in Russia, 354.
economic, in the Gold Coast, 450.
economic, notes, 546.
effect of high frequency radio waves, 655.
effect of man on, 848.
forest. (*See* Forest insects.)
greenhouse, fumigation for, N.Y.Cornell, 155.
in Scotland, 547.
inhabiting roots of weeds, 548.
injurious, Conn.State, 547.
injurious, in Canada, 849.

Insects—Continued.
injurious, in Illinois, 547.
injurious, in Kansas, Kans., 151.
injurious, in New Jersey, 849.
injurious, in Nyasaland, 657.
injurious, in Pusa, 657.
injurious, in Sweden, 54.
injurious to crops. (*See special crops.*)
list with date and locality of occurrence, N.J., 749.
metabolism, 350.
of Bermuda, 354.
of flower gardens, control, 450.
of India, list of publications, 355.
orchard. (*See* Orchard insects.)
parasitic, annotated list, 350.
relation to celery heart rot, 239.
research work in Philippines, 355.
scale. (*See* Scale insects.)
temperatures of, studies, Kans., 151.
toxicity of lead salts to, 248.
transmission of surra experiments, 660.
(*See also* Entomology.)
Insulating material for buildings, tests, Colo., 177.
Insulin—
action in normal persons, 297.
and pituitrin, interaction, 567.
commercial, vitamin B in, 694.
effect on gastric motility in vitamin B deficiency, 193.
Insurance, fire, farmers' mutual, developments and problems, U.S.D.A., 82.
International—
Congress of Plant Sciences, papers, 327.
Congresses in 1930, 100.
Soil Congress, notes, 100, 800.
yearbook of agricultural legislation, 289.
yearbook of agricultural statistics, 289.
Intestinal—
canal of animals, pH value on vitamin B deficient diet, 794.
worms in poultry, iodine for, Mich., 469.
worms in poultry, prevention, Ill., 772.
Intestines of rats, pH of, 888.
Iodide salts, continued administration, effects, 393.
Iodine—
application as index to maturity of apples, 527.
colloidal, use for animal parasites, Mich., 768.
effect on yield of head lettuce, Oreg., 18.
in Maryland waters, relation to goiter, 393.
in nutrition, 590.
requirements of sheep, Iowa, 362.
vermicidal value, Mich., 469.
Ions, divalent, migration data and theory of complete dissociation, 708.
Iowa College, notes, 199, 598.
Iowa Station, notes, 199.
Iowa Station, report, 894.
Iridomyrmex iniquus, establishment in United States, 256.
Iris, chromosome number in, 24.
Iris mosaic disease, control, Oreg., 44.
Iris resistance to *Heterosporium gracile*, 841.
Irish Free State, agricultural education and research in, notes, 500.
Iron—
accumulation in nodes of corn plant, Ohio, 445.
and other substances, effect on blood regeneration, 590.
in Chinese foods, 589.
in diet, calculation, U.S.D.A., 191.
in nutrition, 70.
in plant tissue fluids, studies, N.J., 718.
in rats at different ages, 790.
inorganic, supplementary value for milk diet, 490.
of meats v. iron of other protein foods, utilization, 791.
permanganate titration, 502.
retention during growth and utilization, 257.
Irradiation of food products on commercial scale, feasibility, Wis., 195.
(*See also* Ultra-violet.)
Irrigation—
and water supply, 381.
canals, weed control in, 830.
districts in California, 877.
enterprises, defaulting, financial settlements, U.S.D.A., 785.
projects, 285.
pump, studies, Nebr., 877.
pumping plants, Colo., 276.
studies, Calif., 378; N.Mex., 275; Utah, 75.
system for farm garden, Okla.Panhandle, 177.
water, application, Idaho, 876.
water, duty of for crops, Oreg., 27.
water, measurement, Utah, 774.
(*See also special crops.*)
Ixodiphagus caucurtei, paper on, 656.
Japanese beetle—
effect of feeding on geraniums, 555.
grubs, predacious insects attacking, 858.
in Pennsylvania, summary, 662.
injury, 555.
latest control measures, 849.
on shade trees, community spraying for, 855.
scouting and quarantine enforcement for, Conn.State, 547.
summary, 555.
trap for, 555.
Japanese beetles, immature, hot-water treatment for, effect on plants, 546.
Jellies, rôle of pectin in, Del., 610.

Jerusalem-artichokes—
as sugar plant in Russia, 828.
change in ash content during storage and cooking, Kans., 190.
culture experiments, Utah, 27.
studies, Oreg., 32.
utilization by a diabetic patient, 195.
Jewish agricultural colonies in Palestine, 381.
Johne's disease—
johnin test, Wis., 173.
of cattle, johnin v. avian tuberculin as diagnostic agent, 675.
Kafir—
and corn stubble, decomposition rates, 620.
and milo response to variations in spacing, 518.
smut, notes, 539.
v. sorgo for dairy calves, Kans., 167.
varietal comparisons, Kans., 126.
Kafirs as forage sorghums, Okla.Panhandle, 32.
Kale, cost of production, Oreg., 784.
Kale, effect on clay soil, Oreg., 19.
Kamala as anthelmintic for tapeworms in bears, 273.
Kamala for tapeworms, Va., 768.
Kansas College, notes, 97, 395, 899.
Kansas Station, notes, 97, 395, 899.
Kansas Station, report, 197.
Kentronothrips, new genus, erection, 850.
Kentucky Station, notes, 199, 598.
Kentucky Station, report, 498.
Kentucky University, notes, 199, 598.
Kerlee, B., obituary account, 656.
Ketones, chemical constitution and germicidal activity, 410.
Kidneys, injury from protein of diet, 389.
Killifish, Mexican, pigment inheritance in, 820.
Kose disease in cattle, 571.
Kumquats, hardiness, Miss., 438.
Labor—
Mexican, in United States, 883.
movement and cooperation, 381.
(See also Agricultural labor.)
Laboratory—
of agricultural chemistry of Chinese Eastern Railway, notes, 600.
technic, treatise, 609.
Lactation—
difficulties in rats on stock diet, 694.
inheritance of persistency, 257.
yeast effect relation to copper, 92.
Lactic acid bacteria, action, Wis., 107.
Ladybird beetle, Australian, paper on, 657.
Ladybird beetles, notes, Calif., 351.
Lambs—
cysticercus invasion of liver in, 69.
fattening, N.Mex., 259.
fattening, fall v. winter, 258.
fattening rations for, Colo., 760.
feeding experiments, Idaho, 859; Ind., 259; Kans., 161; Nebr., 859; Oreg., 60.
Lambs—Continued.
finishing, Mich., 458.
Merino ram, dehorning, Ohio, 458.
stomach worms in, nutrition v. treatment, Ohio, 472.
(See also Sheep.)
Lamps, arc v. Mazda for lighting poultry houses, Oreg., 74.
Land—
clearing of stones, Minn., 774.
credit. (See Agricultural credit.)
development and utilization policy, Mont., 684.
drainage in England and Wales, report of Royal Commission, 477.
economics, textbook, 285.
grant colleges. (See Agricultural colleges.)
in Lincoln Co., use and taxation, Wis., 381.
plaster. (See Gypsum.)
reclamation after drainage, Idaho, 876.
selling prices, factors affecting, Calif., 80.
summer use relation to soil moisture, Okla.Panhandle, 432.
utilization, studies, 283, 284.
valuation, papers on, Mo., 883.
values, Kans., 179.
values, farm, trends in, 284.
Lands—
marginal, problem, Mo., 883.
marginal, utilization, N.Y.Cornell, 884.
public, and immigration, 284.
swamp. (See Swamps.)
Larch, fruit cast, studies, 349.
Larkspur oils and alkaloids, insecticidal tests, 248.
Lasius niger americanus, notes, Mich., 359.
Laspeyresia molesta. (See Peach moth, oriental.)
Laundering, effect on fabrics, 897.
Lawn grasses—
changes caused by fertilizers, Md., 824.
fertilizer experiments, R.I., 825.
Lawn weed, control, Calif., 828.
Lawns, clipping tests, Miss., 434.
Lead arsenate—
adhesion on apple foliage, N.J., 751.
and oil combinations, insecticidal value, Wash.Col., 551.
on cranberry bogs, studies, N.J., 451.
sprayed on cranberries, cumulative effect, N.J., 752.
Lead salts, toxicity to insects, 248.
Leaf—
miners, parasites of, 856.
roller, red-banded, notes, Va., 752.
structure, optimal light utilization, expression, 324.
Leafhopper—
insecticide, rôle of Bordeaux mixture, 548.
six-spotted, introduction and distribution, 249.

Leafhopper—Continued.
six-spotted, transmission of yellows disease by, Calif., 238.
Leafhoppers—
affecting cranberries, N.J., 751.
immigrants from tropical regions, 249.
injury to legumes, 250.
notes, Va., 753.
on sugar beets in Iowa, 250.
(*See also special hosts.*)
Leather oils, studies, 544.
Leaves—
oil-sprayed, chlorophyll in, 544.
plasticity and xeromorphic structure, 425.
starch content, daily ranges, 628.
water content, relation to wilting of plants, 627.
wilting, stomatal aperture in, 425.
Lecithin, effect on butterfat determinations, 204.
Lecithin-caseinogen complexes, studies, 306.
Left-handedness, inheritance, 820.
Legume hay for dairy heifers, 257.
Legume inoculants, inspection, N.J., 437.
Legumes—
bacteroid-like *form and immunity in*, 327.
distribution in Oklahoma, 330.
for cover crops, N.C., 725.
forage, behavior, Md., 823.
in rotation, merits, Miss., 433.
in soil improvement, Ind., 207.
injury from potato leafhopper, 649.
inoculation, effect of stock and scion, 325.
(*See also* Nodule bacteria.)
leafhopper injury to, 250.
merits, Oreg., 27.
seeded in corn, tests, Va., 717.
studies, Calif., 327.
tests, 220.
v. nonlegumes for soil improvement, N.J., 715.
varieties, Oreg., 26.
variety tests, Kans., 125.
vitamin C in during germination, 295.
(*See also* Green manure *and* Alfalfa, Clover, *etc.*)
Leis conformis, notes, Calif., 351.
Lemon trees, axial gradient of growth in, Calif., 822.
Lemons—
effect of freezing temperature, Miss., 438.
propagation studies, Calif., 335.
ripening process in, 529.
Lentils, characteristics and culture, 222.
Lenzites sepiaria, notes, U.S.D.A., 148.
Lepidoptera—
of Japan, 55.
tropisms and sense organs, 660.
Lepidosaphes ulmi. (*See* Oyster-shell scale.)
Leptinotarsa decemlineata. (*See* Potato beetle, Colorado.)
Leptocera spp., reared in laboratory, 848.
Leptopsylla musculi, notes, 660.
Leptospira icterohaemorrhagiae in wild rats, 872.
Lespedeza—
breeding experiments, Tenn., 127.
Kobe, notes, Ga., 125.
variety tests, Miss., 433; Tenn., 127.
Lettuce—
aluminum in, detection, Mich., 712.
culture, notes, N.Mex., 228.
downy mildew, studies, Mass., 839.
fertilizer experiments, Kans., 138.
heading varieties, Hawaii, 733.
heading variety, N.J., 734.
inheritance in, 429.
new hard heading variety, Mass., 833.
paper mulch experiments, Mich., 37; Ohio, 440.
seed germination, studies, Calif., 335.
tipburn, studies, N.C., 735.
top-root ratio, studies, 522.
variety tests, N.Dak., 735.
yellows, identity and transmission, Calif., 238.
yields under ultra-violet glass, 834.
Leucocytes in milk, sanitary significance, N.Y.State, 562.
Leucopis americana, notes, 549.
Leukemia, bovine, experimental studies, 270.
Levuana iridescens relation to Malaysian coconut zygaenid, 753.
Libraries, rural, in Montana, Mont., 488.
Lice, mites, and other pests of poultry, control, N.J., 451.
Lice on poultry in Hawaii, 856.
Lice, plant, evolution of cycles and origin of heteroecy, 550.
Light—
artificial, effect on codling moth behavior, *251*.
artificial, effect on egg production S.Dak., 62.
effect on development of root systems 424.
intensity effect on soybean growth, 32[illegible]
requirements of forest species, 42.
utilization, effect on leaf structur 324.
wave length, effect on seed germin tion, 515.
(*See also* Sunlight.)
Lignification, physiological significan[illegible] 628.
Lignin—
behavior in decomposition of plan 803.
in wood decomposition, 720.
preparations from pine wood, 202.
Lilac forcing experiments with calci[illegible] cyanide, 887.
Lilac tineid, morphology and biology, 5[illegible]
Liliaceae, Uredineae in, biology, 849.
Lilies, treatise, 530.
Lilium longiflorum, virus disease, 654.

Lily-of-the-valley forcing experiments with calcium cyanide, 887.
Lima beans. (*See* Beans, Lima.)
Limax maximus, control, 546.
Lime—
analyses, N.J., 21.
and fertilizer tests, N.J., 715.
arsenate. (*See* Calcium arsenate.)
effect on deteriorated tropical soil, 511.
effect on potatoes, N.C., 715.
effect on soil moisture, 207.
on acid soils, crop response to, 209.
penetration after surface application to pastures, 209.
products, inspection, Mass., 322.
requirements of soils. (*See* Soils.)
row method of application, Mich., 418.
surveys, 624.
symposium on, 624.
v. superphosphate for different soil types, Kans., 117.
(*See also* Calcium *and* Liming.)
Limestone—
effect on pastures, Conn.Storrs, 431.
phosphatic, as mineral supplements, 257.
spreader, home-made, specifications, Oreg., 20.
Lime-sulfur spray residues, effect on canned peaches, 612.
Liming—
and soil acidity, Nebr., 812.
effect on tobacco, Conn.State, 135.
experiments, R.I., 614; Va., 716, 727.
(*See also* Lime *and special crops.*)
material effect on sulfur drainage from soil, 624.
material, Kentucky marl beds as source, 624.
materials, comparisons, Ind., 623.
Linen fabrics, effect of laundering, 897.
Linkage in barley, 629.
Linkage in corn, studies, 216.
Linkage of a higher order, 215.
Linseed meal—
v. cottonseed meal for steers, Wis., 161.
v. cottonseed meal for wintering calves, Okla.Panhandle, 559.
v. soybeans for milk production, Kans., 166.
Lipin-protein complexes, studies, 806.
Lipochromes, vitamin A action of, 793.
Lipoid and amide, relations, 818.
Liponyssus sylviarum, control, 546.
Liquids, total solids in, determination, 309.
Lithiasis and bitter pit of pears, 653.
Liver—
fluke in South Wales, summary, 675.
fluke, intermediate host of, 856.
flukes in sheep and goats, Oreg., 68.
pig's, carotin in, tests for, 491.
Livestock—
and livestock products, Kansas, marketing, Kans., 180.
Day, program, Ohio, 59.
Livestock—Continued.
diseases. (*See* Animal diseases.)
economic study in purchase region, Ky., 782.
effect of feeding sugar beet by-products, Utah, 58.
farm, buildings, and equipment, W.Va., 79.
in transit, maintaining health, U.S.D.A., 570.
industry, our responsibility to, 257.
marketing by trucks, Ohio, 481.
marketing, direct packer buying in, 578.
marketing in Baltimore, Md., 887.
poisoning by *Drymaria pachyphylla*, N.Mex., 267, 373.
(*See also* Plants, poisonous, *and specific plants.*)
prices for farm relief, 285.
rations, balanced, Okla.Panhandle, 59.
shipping associations, cooperative practices and problems, Ill., 886.
standards, advantages, U.S.D.A., 157.
statistics. (*See* Agricultural statistics.)
(*See also* Animals, Mammals, Cattle, Sheep, *etc.*)
Locust, black—
culture and yields, Pa., 740.
planting Miss., 443.
Locusta migratoria—
in central Russia, 854.
studies, 54.
Locustana pardalina, studies, 55.
Locusts and grasshoppers, handbook, 54.
Locusts, plague in Cyprus, 548.
Locusts, seventeen-year. (*See* Cicada, periodical.)
Loganberry dwarf disease, description, 244.
Lonchaea occidentalis, notes, Calif., 659.
Longitarsus waterhousei, habits and control, Mich., 358.
Lotus borer, life history studies, Iowa, 854.
Louisiana Stations, notes, 97, 396.
Louisiana University, notes, 97, 396, 599.
Loxosceles rufescens, poisoning from bite of, 663.
Lucern. (*See* Alfalfa.)
Lucilia sericata larvae, locomotor movements, effect of temperature, 855.
Lumber, kiln-dried, absorption of moisture by, 278.
(*See also* Timber *and* Wood.)
Lunger disease of sheep, Utah, 69.
Lungworms in sheep and goats, Oreg., 68.
Luperina stipata, notes, Iowa, 354.
Lyctus powder-post beetles, life history and habits, 855.
Lygus pabulinus, studies, 850.
Lygus pratensis. (*See* Tarnished plant bug.)
Lygus spp., injury to fruits, Conn.State, 547.
Lymnaea spp., hosts of liver fluke, Oreg., 68.

Lymnaecia phragmitella, notes, Mich., 450.
Lymphangitis, inoculation experiments, Calif., 370.
Lysimeter—
equipment, description, Va., 713.
for study of leaching of nitrogen, notes, 798.
Macadamia nut, propagation, Hawaii, 732.
Machine, mulch paper laying, essentials, Mich., 779.
Machinery. (*See* Agricultural machinery.)
Macrocentrus abdominalis, notes, U.S.D.A., 57.
Macrocentrus ancylivora, notes, 798.
Macrosiphum dirhodum, notes, 244.
Macrosporium parasiticum, notes, 345.
Macrosporium porri, studies, 345.
Magnesia, effect on quality of tobacco, Conn.State, 136.
Magnesium—
and calcium in soil, effect of moisture and cropping, 511.
and calcium, separating, method, 711.
chlorate as substitute for sodium chlorate, 227.
deficiency of sandy soil types, N.C., 718.
in Chinese foods, 589.
in zeolitic soils, Ariz., 618.
Magnolia scale, studies, 250.
Maize. (*See* Corn.)
Malacosoma americana. (*See* Tent caterpillar, eastern.)
Malaria—
bird, studies, 274, 275.
control in Egypt, 854.
control in Italy, 854.
rôle of Anopheles mosquitoes in, 554, 660.
(*See also* Mosquitoes *and* Anopheles.)
Mallophaga. (*See* Poultry lice.)
Malnutrition relation to nervousness, 591.
Malt extract and cod-liver oil emulsions, composition, 387.
Malta fever. (*See* Undulant fever.)
Maltose, determination, 109.
Malus ioensis, chromosome characteristics, 427.
Mamestra brassicae, transmission experiments with virus diseases, 651.
Mammals affecting tobacco, 548.
Mammals, North American, field book, 542.
(*See also* Animals *and specific kinds*.)
Mammary glands, development, 257.
Mammary glands of male guinea pigs, effect of human placental extract, 631.
Mammitis. (*See* Mastitis.)
Mandarins, notes, Calif., 841.
Manganese—
arsenate as control for codling moth, 552.
as factor in hemoglobin building, 90, 791.
chloride, effect on nitrification, 623.
deficiency in a lime-induced chlorosis, 533.
Manganese—Continued.
dioxide in soil, detection and significance, 512.
dioxide in soil, effect on accuracy of quinhydrone electrode, 203.
electrometric titration, 712.
in foods, 590.
sulfate, effect on nitrification, 623.
Manganese-copper-iron complex as factor in hemoglobin building, 791.
Mangels, composition, factors affecting, 82.
Mangoes, acclimatization tests, 529.
Mangoes, side tongue grafting, Hawaii, 732.
Manila hemp. (*See* Abaca.)
Manure—
artificial, production, 620, 621; Iowa, 818.
effect on soil nitrogen, Wis., 118.
fertilizing value, Oreg., 20.
Maple—
scale, cottony, control, Ind., 353.
sirup acids, 804.
sirup and sugar, cost of production, Vt., 83.
sirup and sugar prices, factors affecting, Vt., 84.
sirup, flavor constituents, 804.
sugar industry in Quebec, instruction and research in, 299.
sugar orchard, cost and profit in, Vt., 85.
Maples, Norway, fertilization, 837.
Marasmia trapezalis on sugarcane in western hemisphere, 246.
Mares, gestation period, variation in, cause, 822.
Margarine—
vitamin-containing, standardization, 297.
vitamin content, 390.
Margarines, fluorescence, measurement, 292.
Margarodes vitium on grape roots, 250.
Margaropus calcaratus, transmission of babesiellosis by, 175.
Market—
Columbus wholesale, receipts, Ohio, 181 482.
gardens. (*See* Truck crops.)
information and farmer's problems 285.
information service in California, de velopments, 688.
legislative information service, 688.
reports, U.S.D.A., 85, 188, 384, 48 584, 787, 887.
world wheat, and wheat prices, N.Y. Cornell, 184.
Marketing—
cooperative, associations, pooling practiced by, U.S.D.A., 384.
cooperative, papers on, 285.
direct, limitations and advantages, 2
problems and developments, papers 688.
roadside, Mich., 187.
(*See also special products.*)

Markets, foreign, papers on, 688.
Marl dredging from Michigan lakes, equipment, 625.
Marl excavating bucket, notes, Mich., 772.
Marl, fineness, determination, 321.
Martyniaceae, systematic botany of, N.Y. State, 513.
Maryland Station, report, 898.
Maryland University, notes, 200.
Masicera senilis, notes, U.S.D.A., 57.
Massachusetts—
 College, notes, 200.
 plan of taxation for public schools, 883.
 Station, report, 898.
Mastitis, streptococcic, studies, 72.
Materials, strength of, treatise, 691.
Mayetiola destructor. (*See* Hessian fly.)
McNary-Haugen bill and stabilization of farm prices, 285.
Meadow—
 grass, establishment, effect of seed rate, 29.
 plant bug, notes, Iowa, 353.
Meal worm—
 dark, life history and habits, U.S.D.A., 453.
 yellow, life history and habits, U.S.D.A., 453.
Mealybug—
 citrophilus, control, Calif., 350.
 citrophilus, from Australia, new insect enemies, 659.
 citrophilus, parasites, 758.
 citrus, on coffee, 850.
 (*See also specific host plants.*)
Meat—
 and milk hygiene, 70.
 cooked, judging, 257.
 cooking, 257.
 diet, exclusive, effect on blood constituents, 589.
 histological studies, 257.
 inspection, municipal, 70.
 inspection service, Federal, 70.
 meal proteins, growth value, 63.
 meal v. milk, effect on development of chicks, N.C., 764.
 mechanical test for tenderness, 257.
 nutrition studies, Iowa, 387.
 of grass-fat cattle, composition and quality, Kans., 160.
 project, cooperative, 1929 conference on, 700.
 proteins, value in chick rations, 667.
 quality and palatability, methods of study, 257.
 quality and palatability project, color in, 257.
 quality, measures of, 257.
 scraps, value for chicks, Ind., 365.
 standards, advantages, U.S.D.A., 157.
 through the microscope, treatise, 664.
 (*See also* Beef, Pork, *etc.*)
Media. (*See* Culture media.)
Mediterranean fever. (*See* Undulant fever.)
Melanogaster ampelophila. (*See* Pomace fly.)
Melanopsammopsis ulei, notes, 648.
Mellon Institute, industrial fellowships, 100.
Meloidae, North American, reclassification of genera, 358.
Meloini, revision and descriptions of new species, 358.
Melolontha melolontha, flight stimulus and other activities, 753.
Melon bacterial wilt, thermobyetics of, 52.
Melon fly, notes, 358.
Melon fly, synonymy, 354.
Melons—
 as sugar plant in Russia, 828.
 mildew-immune varieties, Calif., 336.
 ripening, Calif., 336.
 ripening with ethylene gas, Minn., 39.
 spray schedule for, 753.
 yields under ultra-violet glass, 834.
Men and insects, foibles of, treatise, 51.
Menhaden fish oil as adhesive for sprays, 249.
Meningo-encephalitis in pigs, Ind., 370.
Mercury—
 compounds as substitutes for corrosive sublimate, tests, Mich., 443.
 compounds, organic, as seed disinfectants, 842.
 salts as soil insecticides, 543.
Meristems, development, 825.
Meromyza americana. (*See* Wheat stem maggot.)
Merulius domesticus on conifers, results, 542.
Messatoporus, new genus, erection, 758.
Metabolism—
 and body temperature of normal persons, 491.
 basal, of young women, Ohio, 492.
 experiments on man with soybean diet, 190.
 of animals, measuring equipment and technic, N.H., 857.
 of Eskimos, studies, 87.
 of infants fed on soybean milk, 190.
 of insects, 350.
 phosphorus and calcium, of rats, 793.
 studies with pigs of different breeds, 260.
 tests with calves, Iowa, 361.
Metal cutting oils, studies, 544.
Metallic corrosion in milk products and effect on flavor, 563.
Metals, corrosion, effect of surface films, 878.
Metals in dairy equipment, corrosion, 866.
Metaphen for chicks, tests, R.I., 676.
Meteorological—
 observations, Mass., 110, 814, 713; Ohio, 416; U.S.D.A., 110, 111, 813, 416, 487, 613, 718.
 observations at Blacksburg, 1919–1927, Va., 718.

Meteorological—Continued.
observations at Huntley, Montana, U.S.D.A., 797.
observations at Lansing, Michigan, 416.
Meteorology—
agricultural, in British Empire, conference, 799.
papers on, U.S.D.A., 111, 313, 613.
(*See also* Climate, Rainfall, Temperature, Weather, *etc.*)
Meters, fluid, theory and application, 476.
Methionine, amino-acid, constitution and synthesis, 201.
Metropolitan Certified Milk Producers, proceedings, 563.
Mica and other dusts, insecticidal value, 552.
Mice—
albino, age at sexual maturity, 327.
outbreak in Kern County, California, 850.
protection of fruit trees from, Ohio, 836.
suckled by rats, growth, 258.
Michigan—
College, notes, 200, 397, 599.
Station, notes, 200, 397, 599, 899.
Station, quarterly bulletin, 498.
Station, report, 498, 797.
Microbracon brevicornis, notes, U.S.D.A., 57.
Micrococcus—
melitensis and *Bacillus abortus*, differentiation by chemical substances, 71.
melitensis, pathogenicity for man and monkey, 372.
spp., notes, 293.
Microgaster tibialis, notes, U.S.D.A., 57.
Microorganisms—
in soil, effect of carbon disulfide treatment, 510.
in soil, effect of plant growth, 509.
morphology and the d'Herelle phenomenon, 720.
sodium benzoate toxicity to, effect of pH, 412.
(*See also* Bacteria.)
Microsphaera alni extensa, perithecia formation, 841.
Milk—
acid v. sweet for infants, 892.
acidified, for infant feeding, Wis., 191.
bacteria in, reduction by electropure process, Mich., 867.
can washing machines for German dairies, 479.
cans, dry, importance, 768.
cans, heating, studies, Calif., 875.
certified, conferences held in 1928, 563.
certified v. pasteurized, for infants, 587.
clean, production, essentials in, Mich., 467.
Milk—Continued.
composition, variations in, 672.
consumption and growth of school children, 587.
cost of handling in country plants, N.Y.Cornell, 183.
cost of production, Kans., 168.
cow's and human, for infants, vitamins in, 493.
deficiencies, supplementing, Ohio, 465.
direct iodizing, Mich., 467.
effect of feeding turnips, Oreg., 67.
effect of flaxseed and cottonseed meal feed, N.J., 765.
electrical conductivity, 766.
evaporated, heat coagulation, 266.
evaporated, heat stability relation to temperature of forewarming, 565.
evaporated unsweetened, value for infants, 588.
factory tests, Idaho, 808.
fever, account, Okla.Panhandle, 873.
fever, physiology, 570.
fever, studies of blood in, 270.
filterer v. clarifier for, S.Dak., 67.
flavors, abnormal, cause, Mich., 868.
for infant feeding, kinds, 790.
high grade, production, Ill., 563; Okla. Panhandle, 466.
homogenization, fat clumping in, 868.
houses and equipment on the farm, Mich., 779.
human, and vitamin A, 494.
human, composition, 90.
human, vitamin in, variability, 292.
inorganic constituents, 888.
irradiated, effect on phosphorus and calcium metabolism of infants, 496.
keeping qualities, determining with quinhydrone electrode, Mass., 867.
leucocytes in, sanitary significance, N.Y.State, 562.
market, handling, 866.
marketing, Mich., 288.
nutritive value, 490, 587; Okla.Panhandle, 498.
of cows receiving cod-liver oil, composition, 264.
pasteurization, *Bacterium coli* test for, 867.
pasteurization, effect on cream line, 265.
plants, country, location, 579.
powder, copper in, nutritional value, 491, 565.
powdered, for infants, 587.
production—
effect of flies and fly sprays Calif., 867.
effect of ground hay, S.C., 66.
effect of number of milkings pe[r] day, Idaho, 865.
effect of temperature and humi[d]ity, N.J., 765.
in Massachusetts, tendencies, 28[?]
in summer, causes of decli[ne], Okla.Panhandle, 562.

Milk—Continued.
products, flavor, effect of metallic corrosion, 563.
sales, from northeastern Ohio farms, variations in, Ohio, 481.
samples, composite, accuracy, Ohio, 466.
sanitary, control, use of bacterial counts in, N.Y.State, 562.
secretion, studies, 264.
separation tests, S.Dak., 75.
skimmed. (*See* Skim milk.)
substitutes for calves, Mass., 866.
surplus and milk residues in Scotland, 887.
tubercle bacilli in, electrical conductivity method of treating, 471.
unpasteurized, microscopic appearance, N.Y.State, 562.
v. meat meal, effect on development of chicks, N.C., 764.
value in chick rations, 667.
vitamin D in, effect of cow's ration, Ohio, 170.
vitamin D in, variations, 695.
yields, variations in, cause, 263.
Milking, art of, 671.
Milking machines, washing and sterilizing, Ind., 368.
Milkweed—
cultural requirements, Iowa, 338.
rubber from, Iowa, 338.
Millet—
smut, control, 239; Kans., 145.
smut, notes, 539.
variety tests, N.Dak., 726; N.Mex., 219.
Milo and kafir response to variations in spacing, 518.
Mincola scitulella, notes, Idaho, 848.
Mineral—
constituents in cranberries, 491.
feeds, feeding value, Mich., 464.
metabolism of dairy cows, Kans., 166.
requirements for pigs, Wis., 163.
requirements in animal nutrition, Iowa, 361.
requirements of heifers, Oreg., 65.
Minerals—
effect on chloroplast pigments in soybeans, 824.
for feeding with corn, Ohio, 463.
in dairy cattle feeding, Iowa, 868.
in grains, Utah, 409.
in juice and whole apple, comparison, 810.
sources for poultry, S.Dak., 62.
v. protein supplements for fattening pigs, N.C., 762.
Minnesota Station, report, 699.
Minnesota University, notes, 299.
Mint flea beetle, habits and control, Mich., 358, 749.
Miridae of Ohio, 356.
Miris dolabratus. (*See* Meadow plant-bug.)
Mississippi—
College, notes, 397.
Station, Holly Springs Branch, report, 498.
Station, notes, 99, 397.
Station, Raymond Branch, report, 498.
Station, South Branch, report, 498.
waterway, 285.
Missouri—
Fruit Station, report, 797.
Station, notes, 299, 899.
University, notes, 599, 899.
Mite, tropical fowl, in Ohio, Ohio, 456.
Mites—
affecting evergreens, 753.
affecting poultry, control, Nebr., 175.
infesting fruit trees, 354.
lice and other pests of poultry, control, N.J., 461.
on dried fruit, 850.
Moisture—
determination in substances high in fat, 310.
distribution in apple twigs, Minn., 39.
in plant tissue, R.I., 615.
Moko disease in Trinidad, 648.
Molasses, cane, for finishing calves, Iowa, 759.
Molasses, vitamin E in, 597.
Mold growth in soil, effect of vegetable material added, 510.
Molluscum in hens, virulicidal serum against, 677.
Molybdic acid—
as precipitant for blood proteins, 807.
solution, method of making up, 12.
Monilia and Sclerotinia species, taxonimic position, 845.
Monilia cinerea, notes, 348.
Monilia nigra, notes, 250.
Monilochaetes infuscans, notes, N.C., 746.
Monochamus notatus, control, 358.
Monochamus scutellatus, control, 358.
Montana—
plan of taxation for public schools, 883.
State Board of Entomology, report, 656.
Station, notes, 200.
Mosaic diseases, diagnosis, new ways, Wis., 149.
(*See also specific host plants.*)
Mosquito—
larvae and pupae, destruction, 357, 553.
larvae, toxic spray for, Md., 656.
oils, studies, N.J., 752.
Mosquitoes—
biological studies and control, N.J., 752.
breeding, relation to composition of water, 55.
control, Conn.State, 547.
eradication from coastal marshes, N.H., 152.
mountain, control, Calif., 352.

Mosquitoes—Continued.
of New Hampshire, life history and control, N.H., 854.
of the Americas, 55.
studies, Mont., 153.
transmission of fowl pox by, 274.
(*See also* Anopheles, Malaria, *and* Yellow fever.)
Moth, pitch-ball making, of jack pine, notes, Mich., 450.
Moth-proofing material, tests, 853.
Moths, fruit-piercing, 550.
Moths of New Zealand, 755.
Moths, zoophilous, in Argentina, 55.
Motor cultivators. (*See* Cultivators.)
Motors, current consumption of, 478.
Mower, power requirements, effect on different speeds, 682.
Muck soil problems, N.C., 713.
Murgantia histrionica. (*See* Harlequin bug.)
Musca domestica. (*See* House flies.)
Muscidae, studies, 55.
Muscle hemoglobin concentration during growth, effect of diet, 392.
Muscular efficiency on high carbohydrate and high fat diets, 693.
Mushroom pest, new, notes, 354.
Mushrooms, culture, U.S.D.A., 140.
Muskmelon mildew, studies, Calif., 341.
Muskmelon seedlings, effect of treating seeds with ethyl alcohol, 514.
Muskmelons, fertilizer experiments, Ill., 37.
Muskmelons, vitamin A in, Ga., 193.
Mustard—
acid-sensitive, studies, 719.
control, N.H., 127.
use against sheep parasites, 675.
Mutation rate in Drosophila, variability, 218.
Mutations—
from variegation to self color in corn, 722.
production by X-rays, 820.
Mycorrhiza of southern pines, 819.
Mycorrhiza rôle in plant growth, 514.
Myeloborus, new genus, erection, 662.
Myiopardalis pardalina, synonymy, 354.
Myzus persicae. (*See* Peach aphid, green.)
Myzus spp., transmission experiments with virus diseases, 651.
Naganol and Germanin, comparison, for trypanosomal and spirochetal infection, 569.
Nanophyes salmincola, notes, Oreg., 69.
Naphthalene—
for red spider control, Mass., 849.
maximum weights in inclosed space, 545.
tolerance of plants to, 545.
Narcissus—
bulb pests, control in California, 248.
culture, monograph, 529.
mite, notes, 547.
mosaic, notes, Oreg., 44.
Narcissus—Continued.
paper white, biochemical studies, N.J., 734.
root rot, control, Miss., 446.
Nasal granuloma of cattle in India, 472.
National—
agricultural policy, basis for, 285.
Association of Marketing Officials, proceedings, 688.
Country Life Conferences, papers, 579.
4-H Club Camp, editorial, 104.
Grange, attitude toward tariff, 285.
Institute for Research in Dairying, report, 561.
Livestock and Meat Board, report, 664.
Nature in farming, treatise, 489.
Naval stores, tapping pine trees for, principles and practice, U.S.D.A., 443.
Nebraska Station, report, 898.
Necrobacillosis, susceptibility of anemic pigs to, Ind., 370.
Necrology, notes, 399.
Nectarines of Japan, 230.
Nematode disease of sweetpotatoes, N.C., 447.
Nematodes—
in greenhouse soil, control, 542; Mass., 840.
nomenclature, 350.
studies, Calif., 349.
Nematodirus filicollis—
description, 374.
notes, Oreg., 768.
Nematospora spp., notes, 842.
Neolecanium cornuparvum. (*See* Magnolia scale.)
Nervous system of rats, effect on vitamin B deficiency, 495.
Nervousness relation to malnutrition, 591.
Netherlands East Indies, science in, 699.
Nevada Station, notes, 200, 499, 798.
Nevada University, notes, 200.
New England Research Council, proceedings, 283.
New Hampshire—
Station, notes, 900.
Station, report, 197.
University, notes, 599, 799, 900.
New Jersey Stations, notes, 397.
New Jersey Stations, report, 797.
New Mexico Station, report, 298.
New York Cornell Station, notes, 397.
New York State Station, notes, 398, 900.
Newcastle disease of fowl, 275.
Nickel added to iron, effect on blood regeneration, 590.
Nicotiana, self-sterility allelomorphs, 721.
Nicotine—
and Tuba comparison, 549.
bentonite as carrier, 249.
dusts, use against vegetable insects, 849.
in tobacco, factors affecting, 333.
maximum weights in inclosed space, 545.

Nicotine—Continued.
production for insecticides, rôle of beet leafhopper in, 250.
sprays, use against vegetable insects, 849.
sulfate for roundworms, Va., 768.
sulfate, insecticidal value, N.J., 750.
Nicotine-soap preparations, deterioration, 544.
Nightshade mosaic tissue, intracellular bodies in, 843.
Niptus hololeucus, notes, Mont., 153.
Nitella—
accumulation of dye in sap, mechanism, 518.
protoplasm and cell sap, potentiometric determinations, 120.
sap, penetration of dahlia into, 120.
Nitrate—
nitrogen concentrations, R.I., 614.
of potash. (*See* Potassium nitrate.)
of soda. (*See* Sodium nitrate.)
Nitrates—
accumulation, effect on time of plowing for wheat, Utah, 28.
behavior in soil, relation to organic matter, Colo., 115.
determination in green plant tissues, N.J., 719.
in plant solutions, R.I., 614.
in plant solutions, determination, 13.
in sap, effect of soil type and fertilizers, Mich., 717.
in soil, effects of carbon disulfide treatment, 510.
production, effect of crude petroleum, 817.
Nitrification—
effect of sulfate and chloride of manganese, 623.
in Nebraska soils, factors affecting, Nebr., 811.
in orchard soils, changes in, Calif., 420.
Nitrifying bacteria, isolation and study, Idaho, 810.
Nitrite oxidizing organism, use of term, Idaho, 810.
Nitrogen—
absorption and retention of guinea pigs, 296.
absorption by plants from nitric acid and ammonia, relative rates, N.J., 719.
amino and residual in blood, determination method, 503.
availability, studies, N.J., 715.
distribution in apple twigs, Minn., 39.
distribution in bearing apple spurs, Mo., 40.
effect on apples, Mass., 832.
effect on peach growth and production, Ark., 835.
exchange on a one-sided diet of fowls, 298.
fixation by bacteria on artificial media, 214.
Nitrogen—Continued.
fixation, nonsymbiotic, Oreg., 19.
fixation, relation to legumes and nonlegumes, Mass., 810.
in apple and peach growing, value, Md., 831.
in soil, effect of fungi, Wis., 115.
in soil, effect of manure, Wis., 118.
in soil, relation to temperature, 316.
in soybeans, distribution at different growth stages, 520.
metabolism of conifers, 22.
metabolism of plants, effect of deficiencies, 323.
organic sources, Mass., 20.
relation to potassium in tomato plants, 339.
sources for cotton, Ga., 634.
sources of tobacco, effect, Conn.State, 134.
Nitrogenous fertilizers, new, tests, N.C., 622.
Nitrous acid, effect on vitamin G, 711.
Nodule—
bacteria, nitrogen fixation on artificial media, 214.
bacteria relation to legume hosts, 325.
production in clover, Wis., 127.
(*See also* Legumes, inoculation.)
Nodules, parasitic, in cecal wall of chickens, 678.
Nomadacris septemfasciata, studies, 55.
North Carolina—
plan of taxation for public schools, 287.
Station, report, 797.
North Dakota—
College, notes, 99.
Edgeley Substation, report, 797.
Station, notes, 99.
Williston Substation, report, 797.
Nubbin, composition, 215.
Nursery inspection, Conn.State, 547.
Nurserymen's tape, use for tying grafts, Wis., 148.
Nut bud tortrix, paper on, 854.
Nuthatches, woodpeckers, and creepers of New Jersey, N.J., 655.
Nutrient media. (*See* Culture media.)
Nutrition—
animal. (*See* Animal nutrition.)
human, studies, N.H., 192.
laboratory, report, 290.
of cattle, relation to abortion, Wis., 173.
of children, relation to condition of teeth, 892.
of children, relation to pneumonia, 892.
plant. (*See* Plant nutrition.)
Nuts, notes, Miss., 439.
Nuts, studies, Hawaii, 732.
Nyssus gallinae. (*See* Chicken mite.)
Oak—
forests of northern Michigan, Mich., 645.
mildew perithecia, formation, 841.
mildew perithecia, studies, 655.

Oak—Continued.
red, light requirements, 42.
root rot, studies, Calif., 342.
Oaks, scrub, value, Mich., 740.
Oat—
blast, studies, Calif., 344.
crown rust, cytological study, 239.
gray speck disease, 649.
hay, wild, and rolled barley, feeding value, Calif., 362.
loose smut, inoculation studies, 649.
roots, parasite of, 237.
rust studies, Mich., 46.
scab, control, Mich., 842.
seed, effects of dehulling, 223.
smut, control, Idaho, 639; Ohio, 445; Wis., 149.
smut infection, effect of dehulling and seeding date, 223.
smut, studies, Kans., 145.
smuts, physiologic races, 842.
straw, production of artificial manure from, 621.
Oats—
aberrant and false wild types, studies, Kans., 125.
alkali-sensitive, studies, 719.
ash content, factors affecting, Utah, 409.
breeding experiments, 29, 825; Ga., 125; Kans., 125; N.J., 724; Oreg., 26; Va., 726.
cross, correlated inheritance in, W.Va., 517.
culture experiments, Kans., 125; Nebr., 824.
dry land culture, U.S.D.A., 724.
effect of corn borer clean-up preceding, Miss., 436.
fall sown, for Georgia, 331.
feeding value, 257; Ind., 362; Wis., 169.
fertilizer experiments, Miss., 433; Va., 716.
for laying hens, Ohio, 463.
for pigs, feeding value, Wis., 163.
germinated, feeding value for laying hens, Ind., 365.
ground, feeding value, Ind., 665.
hardiness, studies, Kans., 121.
harvest period, Iowa, 329.
hybrid, natural crossing between, 429.
in North-Central States, requirements, U.S.D.A., 728.
light growth reactions in, 817.
marketing in England and Wales, 884.
pure line, effect of environment, 222.
ready for combine, moisture in, Miss., 435.
rolled, irradiating on commercial scale, feasibility, Wis., 195.
rotation experiments, U.S.D.A., 724.
scab, epidemic, Wis., 149.
seeding date effect on germination and smut infection, 223.
Oats—Continued.
seeding experiments, Miss., 436; Ohio, 130.
varietal comparisons, Kans., 126.
varietal date of seeding test, Calif., 828.
varieties, Calif., 437.
varieties and strains, registration, 228.
varieties, early maturing, selecting, 223.
varieties, significance, 29.
variety tests, Idaho, 822; Ind., 829; Kans., 125; Md., 823; Mich., 432; Miss., 436; N.C., 725; N.Dak., 726; N.J., 724; N.Mex., 219; Nebr., 824; Oreg., 26; Pa., 436; Utah, 27; Va., 726; West.Wash., 29.
winter hardiness, N.C., 725.
yellow-kerneled fatuoid, 25, 216.
Oberea myops, life history and habits, 662.
Oberly Memorial Fund bibliographies, 100.
Oecanthus niveus. (*See* Cricket, snowy tree.)
Oesophagostomum venulosum, notes, Oreg., 768.
Oestrous cycle test for vitamin A deficiency, 794.
Oestrus, inhibition in rats, 632.
Office of Experiment Stations, notes, 99, 700.
Ohio—
State University, notes, 299.
Station, bimonthly bulletin, 498.
Station, bulletins, new monograph, 96.
Station, report, 498.
Oil—
meal. (*See* Linseed meal.)
palm plantations, cover crops for, 529.
palms, studies, 529.
sprays, foliage injury from, Oreg., 35.
sprays, preparation and use, N.Mex., 355.
sprays, tests, Wash.Col., 551.
Oil-nicotine combination for control of apple insects, 252.
Oils—
and fats, monograph, 610.
palm, fatty acids of, composition, 802.
water-miscible mineral, studies, 544.
(*See also* Fats, Cod-liver oil, Cottonseed oil, Olive oil, *etc.*)
Oklahoma—
cotton growers' association, attitude of farmers toward, Okla., 484.
Panhandle Station, miscellaneous papers, 96, 498.
Oleomargarine. (*See* Margarine.)
Oligia fractilinea, notes, Ohio, 450.
Olive—
fruit fly, control, 358.
oil, irradiated, effect on phosphorus and calcium metabolism of infants, 496.
Olives—
growing in Union of Socialistic Soviet Republics, 235.
pruning experiments, Calif., 335.

Olives—Continued.
ripe, preservation, effect of pH, Calif., 387.
starch cycle in, Calif., 336.
Onchocerca cervicalis, relation to fistulous withers in horses, Kans., 173.
Onion—
bulbs, storage temperature, Calif., 336.
disease resistance, chemical aspects, 537.
diseases, Iowa, 345.
flies, notes, Iowa, 353.
maggot, notes, 544; Iowa, 353; Ohio, 450; Oreg., 52; Wis., 154.
maggot, status in Wisconsin, 554.
purple blotch, studies, 345.
smudge, notes, 647.
thrips, control, 546; Idaho, 848; Mass. 848.
thrips, notes, Iowa, 353.
thrips on figs, 659.
thrips on tobacco in Turkey, biology, 356.
Onions—
canning and drying, Mass., 889.
change in ash content during storage and cooking, Kans., 190.
cold storage, 229.
culture, Ind., 229; Mass., 832.
Sweet Spanish, notes, Utah, 37.
utilization by canning, Mass., 804.
Oospora citri aurantii—
and Penicillium mixed inoculum for citrus fruits, effect, 747
notes, Calif., 341.
Oospora scabies. (See Potato scab.)
Ophiobolus graminis, notes, 345, 349.
Ophiobolus graminis, studies, Kans., 145.
Orange—
pulp, feeding value for hens, Wis., 164.
seedlings, genetic studies, Calif., 326.
trees, composition, Calif., 336.
worms, notes, Calif., 351.
Oranges—
decay, effect of ultra-violet radiation, 50.
effect of ethylene gas on, Mich., 424.
heat requirements, Calif., 336.
in warehouse precoolers, tests, Calif., 335.
navel, cause of dropping and rotting, Calif., 341.
propagation studies, Calif., 335.
Satsuma, culture, Miss., 442.
Satsuma, effect of freezing temperature, Miss., 438.
Orchard—
cover crops, tests, Colo., 136; Kans., 137.
heating practices, U.S.D.A., 228.
insects, control, 547.
inspection. (See Nursery inspection.)
tree chlorosis, Utah, 45.
Orchards—
fertilizer experiments, Va., 735.
management, Iowa, 388.
spraying, W.Va., 441.
time studies in, N.H., 180.
(*See also* Fruits, Apples, Peaches, *etc.*)
Orchids, symbiosis and asymbiosis relative to, 819.
Orcus australasiae, notes, Calif., 351.
Oregon College, notes, 599.
Oregon Station, report, 96.
Organic matter—
decomposition, principles underlying, 620.
destruction by perchloric acid, 13.
effect on carbon and nitrogen in soil, 207.
effect on soil moisture, 207.
in soil, Mich., 18.
in soil, loss of, Nebr., 811.
in soil, physical aspects, 276.
nitrification experiments, effect of carbon: nitrogen ratios, 507.
Oriental peach moth. (*See* Peach moth.)
Ornamental plants, shrubs, and trees. (*See* Plants, Shrubs, *and* Trees.)
Oroya fever—
etiology, 854.
transmission by Phlebotomus, 55.
Orthodichlorobenzene, commercial, purity, 246.
Orthophosphoric acid, separation and determination, 501.
Orthoptera of New Jersey, revised list, 247.
Orthotolidine test for chlorine in swimming pool water, Mich., 411.
Oscinella frit, studies, 554.
Osteitis fibrosa, studies, 371.
Osteomalacia in horses, 571.
Ostertagia—
circumcincta third-stage larva, biology and morphology, 374.
spp., notes, Oreg., 768.
Ostomidae of New Jersey, 855.
Otiorhynchus ovatus, notes, Utah, 54.
Ovarian hormone, effects in immature monkeys, 631.
Ovaries, mammalian, fertilization experiments and parthenogenesis in, 631.
Ovulation and implantation in cats, mechanism, 631.
Ox warbles, summary, Ohio, 55; U.S.D.A., 757.
Oxalate, adsorption by fuller's earth and norit, 12.
Oxidation-reduction potentials, monograph, 610.
Oyster shell scale, control, Ind., 353.
Oyster shell scale, notes, Mich., 450.
Oysters—
inspection, Me., 693.
Stewart Island, seasonal variations, 692.
studies, N.J., 748.

Pachycoris torridus, parasite of eggs of, 856.
Paddy. (*See* Rice.)
Paints and painting, 282.
Palestine—
agricultural colonization and horticultural possibilities, 881.
sanitary survey, 881.
Survey Commission, Joint, reports submitted to, 881.
Palm, coconut. (*See* Coconuts.)
Palm seed scolytids in Hawaii, 855.
Palmodes laeviventris, notes, Mont., 153.
Palms, oil. (*See* Oil palm.)
Pan-Pacific Science Congress, papers in veterinary medicine, 372.
Papaipema spp. (*See* Stalk borers.)
Papaya fruit fly, notes, 357.
Papaya trees, notes, Hawaii, 732.
Paper mulch—
and soil temperatures, Calif., 314.
experiments, Mich., 37; Ohio, 440.
experiments, suggestions for, U.S.D.A., 440.
machine for laying, Mich., 779.
use in vegetable growing, 228.
Paper pots, use, Okla.Panhandle, 37.
Paper pulp. (*See* Pulp.)
Papilloma tuberosum, notes, 69.
Paradichlorobenze—
experiments for peach borer, 252.
maximum weights in inclosed space, 545.
Paraffine wax, value for transplanted trees and shrubs, 525.
Paralysis—
in chickens, Ind., 371.
of fowls in South Africa, 474.
preparturient, in sheep, control, Utah, 69.
Parasites—
and host plant, summary, 532.
in eyes of Formosan fowls, 574.
insect, annotated list, 350.
intestinal, of chickens, control, 573.
nematode in gizzard of Formosan duck, 574.
of cranberry pests, Mass., 850.
of man and domestic animals, index, 372.
of sheep in Kenya, 874.
of sheep, intracellular, in Northern Caucasus, 374.
(*See also* specific forms.)
Parasitology—
research, Mich., 469.
treatise, 567.
Paratetranychus—
ilicis, life history, Mass., 850.
pilosus. (*See* Red mite, European.)
Paratrioza cockerelli, notes, Utah, 45, 54.
Paratyphoid—
avian, studies, N.J., 769.
infection in calves, diagnosis, 69.
Paresis, parturient. (*See* Milk fever.)
Parkway features of interest to highway engineer, U.S.D.A., 379.
Parsnip webworm, notes, Mich., 450.
Parsnips, change in ash content during storage and cooking, Kans., 190.
Passalurus ambiguus, anatomy, 548.
Pasteurella—
avicida in turkeys, Idaho, 874.
aviseptica infection of poultry, 770.
Pasteurization. (*See* Milk.)
Pasture—
crops, studies, Wis., 128.
experiments, U.S.D.A., 670.
grass v. hay, nutritive value, 857.
mixtures, studies, Va., 727.
plants, variety tests, Va., 726.
v. silage and hay for cattle, Ohio, 457.
Pastures—
carrying capacity, effect of nitrogen fertilization, N.J., 765.
character of vegetation, effect of fertilizers, Md., 824.
effect of fertilizers, Ind., 329.
effect of heavy and premature grazing, Wis., 128.
effect of overgrazing, 220.
eradication of undesirable plants from, Kans., 125.
establishment, 518; Oreg., 26.
fertilizer experiments, Ind., 319; Wis., 128.
for beef cattle, Utah, 59.
for livestock, value and methods, Kans., 158.
for sheep and goats, Oreg., 59.
irrigated, returns from, Kans., 162.
maintenance and improvement, Conn. Storrs, 430.
management, Hohenheim system, Miss., 434.
native, methods of utilizing, Kans., 158.
old, composition in north Wales, 30.
permanent, value for fattening pigs, N.C., 762.
studies, Kans., 125; Va., 726.
(*See also* Grasses *and* Grassland.)
Patents of United States, relating to pest control, U.S.D.A., 543.
Pavements. (*See* Concrete *and* Roads.)
Paving mixtures, bituminous, molding laboratory specimens, machine for, U.S.D.A., 379.
Pea—
blight, overwintering, dissemination, and pathological histology, 240.
industry of United States, N.Y.Cornell, 788.
mildew, control, N.Mex., 236.
root rot, effect on yield, N.J., 743.
(*See also* Peas.)
Peach—
aphid, green—
as agent in virus transmission, 549.
as carrier of tobacco mosaic, Wis., 149.
control, 549.
toxic spray for, Md., 650.

Peach—Continued.
- borer control with paradichlorobenzene in solution, 252.
- brown rot apothecia, two fungi on, 348.
- brown rot studies, 347; Tenn., 147.
- bud hardiness, freezing apparatus for study, Mass., 832.
- buds, killing from low temperatures, *varietal differences*, N.J., 733.
- diseases, control with calcium sulfide, Va., 347.
- fruit buds, hardiness, W.Va., 233.
- *insects, attrahents for, 248.*
- kernels, carbohydrate changes in, Calif., 335.
- moth, oriental—
  - baits for, 252.
  - control, 552.
  - factors limiting control, 251.
  - in Illinois, 547; Ill., 252.
  - in Pennsylvania, 851.
  - insecticidal studies, N.J., 750.
  - notes, Conn.State, 547; Mich., 450; Ohio, 450; Va., 753.
  - on persimmons, 246.
  - paper on, 355.
  - parasites, notes, 798.
  - repellents for, 252.
  - seasonal life history, N.J., 661.
  - summary, N.Y.State, 155.
- rosette, studies, Ga., 144.
- rot, *Tranzschelia punctata*, life history and control, Calif., 341.
- seedlings, studies, N.Y.State, 524.
- trees, fertilizer experiments, N.H., 139.
- trees, rejuvenation and pruning, Md., 831.
- trees, susceptibility to winter injury, effect of fertilizers, N.C., 734.
- twig growth, studies, N.J., 733.

Peaches—
- breeding, 430; N.J., 733.
- canned, cause of swelling cans, 612.
- canning quality, effect of late irrigation, Calif., 378.
- cat-facing, cause, Ind., 353.
- cull, causes, Ga., 137.
- culture experiments, Ind., 338.
- effect of iron sulfate, Calif., 342.
- effect of pruning and thinning, N.C., 735.
- fertilizer experiments, Ark., 835; Mass., 833.
- Gage, growth and characteristics, 233.
- genetic studies, Calif., 326.
- grading and packing, Ill., 738.
- nematode-resistant stocks, Calif., 335.
- on plum stocks, graft affinity tests, 234.
- picking maturity tests, Utah, 37.
- pollination studies, Mich., 230.
- pressure tests, results, N.J., 733.
- price in New York City, factors affecting, U.S.D.A., 488.

Peaches—Continued.
- pruning experiments, Ind., 234, 337.
- refrigeration, in transit, Ill., 836.
- size of fruits and total yields, Mich., 40.
- spray schedules for, W.Va., 442.
- spraying experiments, Tenn., 146.
- spreader tests on, Va., 753.
- thinning studies on individual branches, 835.
- time of planting, Md., 831.
- varieties, N.Y.State, 340.
- variety tests, Miss., 438.
- *vitamins in, Kans., 193.*

Peanuts—
- breeding experiments, Va., 726.
- efficiency for growth in pigs, increasing, U.S.D.A., 462.
- tariff data, 584.

Pear—
- bitter pit and lithiasis, 653.
- *black end, studies, Calif., 335.*
- blight, control, Tenn., 146.
- blight, studies, Oreg., 50.
- blight, value of Bordeaux mixture, 526.
- *brown rot, notes, 653.*
- canker, studies, 653.
- fire blight, overwintering and modes of infection, Mich., 448.
- products, canned, uses, Calif., 387.
- psylla, control, Mich., 749.
- scab, control, 541.
- seedlings, studies, N.Y.State, 524.
- stocks, Oreg., 36.
- target canker, studies, 244.
- thrips on prune, control, Oreg., 52.
- tree chlorosis, treatment, 243; Calif., 342.

Pears—
- Anjou, pollination studies, Oreg., 232.
- Bartlett, effect of branches tied down to horizontal position, Ohio, 439.
- Bartlett, for eastern shipment, maturity standards, Calif., 737.
- bean thrips on, 249.
- breeding experiments, S.Dak., 39.
- budding stocks, importance of leaf spot in selection, 232.
- defective graft unions in, Mich., 525.
- fertilizer experiments, Mass., 832.
- growing with selected buds, 527.
- harvesting and handling studies, Oreg., 35.
- in warehouse precoolers, tests, Calif., 335.
- new seedling, Iowa, 338.
- Pineapple, notes, Miss., 438.
- pollen viability, 527.
- pollination studies, 526; Mich., 230; Oreg., 36.
- ripening with ethylene gas, Minn., 39.
- spray residue removal from, 233, 756; U.S.D.A., 40.
- spray schedules for, W.Va., 442.
- time of picking tests, Oreg., 36.

Pears—Continued.
tracheal sap, variations in composition, Calif., 336.
varieties, N.Y.State, 340.
variety tests, Oreg., 36.
vitamins in, Kans., 193.
winter injury, Oreg., 36.
yields, Kans., 138.
Peas—
and corn, hogging down, N.Dak., 763.
as fall crop, result, N.Mex., 228.
breeding experiments, 29.
canning, varieties, Wis., 127.
composition and quality, effect of temperature, 641.
culture and harvesting practices, Wis., 331.
culture experiments, N.Dak., 726.
duty of water experiments, Oreg., 27.
fertility maintenance for, Md., 622.
fertilizer experiments, Miss., 438.
improvement project, progress, Colo., 136.
inorganic injuries to, 515.
irrigation experiments, Utah, 27.
manufacture and distribution, Md., 383.
of New York, monograph, N.Y.State, 640.
paper mulch experiments, Ohio, 440.
pigeon, variety tests, Hawaii, 723.
production and marketing, N.Y.Cornell, 783.
production, economic study, Md., 583.
seeding experiments, Idaho, 823.
spray schedule for, 753.
time of planting, Md., 831.
variety tests, Idaho, 822; Mich., 432; Miss., 438; N.Dak., 726.
vitamin C in during germination, 295.
yield and quality, factors affecting, Md., 641.
yields, factors affecting, Md., 831.
Peat—
composition, 507.
fertilizers for, Iowa, 319.
profiles in Maine, composition and morphological features, 618.
soil, drained, relation between plant growth and water table, 327.
soils, fertilizer requirements, Wis., 118.
Pecan—
leaf case-bearer control by airplane dusting, 653.
leaf spot, new, 654.
seedlings, sand burn of, 245.
spittle insect, control, N.C., 752.
Pecans—
pollination studies, Ga., 137.
seedlings and varieties, N.C., 785.
storage studies, Ga., 137.
varying susceptibility to *Cladosporium effusum*, 245.
yields, N.Mex., 228.
Pectase in plant tissue, studies, 720.
Pectic substances, chemical relations, Md., 803.
Pectin, enzymic relations, 720.
Pectin extraction, Del., 610.
Pectinase in plant tissue, studies, 720.
Pectinophora gossypiella. (See Bollworm, pink.)
Pectosinase in plant tissue, studies, 720.
Pegomyia—
brassicae. (See Cabbage maggot.)
cepsrum, notes, Iowa, 353.
fusciceps, notes, Iowa, 353.
hyoscyami, notes, Ohio, 450.
Pellagra—
endemic, in cotton-mill villages of South Carolina, 597.
summary, 496.
Penicillium—
expansum, notes, 245.
spp. growth, relation to temperature, 245.
spp., notes, Calif., 341.
Penicillium—
mixed inoculum for citrus fruits, effect, 747.
sclerotia, occurrence and behavior, 533.
Pennsylvania—
College, notes, 99, 398, 799.
Station, notes, 398.
Pentosans, development with formation of pectins in ripening fruits, Md., 803.
Pentoses, fermentation possibilities, Wis., 107.
Peony Botrytis disease, studies, 51.
Pepper—
disease due to potato virus, 846.
Sclerotium disease, notes, 651.
weevil, control, Calif., 351.
Peppermint and spearmint as farm crops, U.S.D.A., 140.
Peppers, fertilizer experiments, N.J., 734.
Peptones, commercial, chemical studies, 410.
Perchloric acid as agent for destruction of organic matter, 13.
Peregrinus maidis, introduction and distribution, 249.
Perennials, herbaceous, propagation, Va. Truck, 740.
Periarticular phlegmons of calves, 878.
Peridermium strobi. (See White pine blister rust.)
Perkinsiella saccharicida, introduction and distribution, 249.
Permeability—
of isolated living membrane, 212.
of living cells, studies, 120.
of protoplasm, 212.
of soils, N.Mex., 206.
Peroxidase in epidermis of various plants, 214.
Persimmons—
as host of oriental fruit moth, 246.
culture and outdoor storage in China, U.S.D.A., 41.
Japanese, in Florida, Fla., 857.
ripening with ethylene gas, Minn., 39.

Pestalozzia—
guepini, notes, 841.
macrotricha, notes, N.J., 748.
sp., pathogenicity, N.J., 748.
Pests of field and garden crops, Mich., 656.
Petri plates, colony formation on, effect of distilled water, 265.
Petroleum, effect on nitrate production, seed germination, and growth, 317.
Petrova albicapitana, notes, Mich., 450.
Pettenkoferien, use of term, 720.
Phaeogenes planifrons, notes, U.S.D.A., 57.
Phedole megacephala, notes, 857.
Phenolic germicides, bactericidal properties, effect of pure soaps, 804.
Phenology of crop pests, interpreting, 52.
Philippine Experiment Stations, survey, 99.
Philippines, University of, notes, 500.
Philophthalmus anatinus n.sp., description, 574.
Phlebatrophia mathesoni and *Phyllotoma nemorata*, synonymy, 661.
Phlebotomus and Oroya fever and verruga peruviana, 55.
Phlebotomus spp., vectors of Oroya fever, 654.
Phleospora ulmi, notes, 841.
Phoma citricarpa, notes, 841.
Phorbia cepetorum. (*See* Onion maggot.)
Phormia regina, dermal myiasis caused by, 757.
Phosphate—
acid-soluble, in soils, effect of cropping, Calif., 317.
Anaconda, toxicity, Mich., 718.
mixtures, pH determination, 309.
requirements of Cherokee silt loam, Kans., 117.
rock, analysis, 109.
Phosphates—
comparison, Iowa, 318.
in blood during milk fever, 570.
in plant solutions, determination, 13.
penetration into pasture soil, Wis., 128.
retention by hydrated alumina, 208.
Phosphoric acid, fixation, Va., 717.
Phosphorus—
and calcium in bone formation in pigs, Ohio, 456.
and calcium ratio in growth of chicks, Ohio, 456.
and sulfur, experiments, S.Dak., 20.
as factors in alfalfa culture, Wis., 119.
balance of milking cows, 257.
deficiency in forage grasses of Montana, 58.
in cell sap, Mich., 418.
in diet, calculation, U.S.D.A., 191.
in soils, studies, Mich., 418.
metabolism in artificially fed infants, 496.
metabolism in rats, 793.
soluble, determinations, refined methods, Mich., 718.
Phthorimaea lycopersicella n.sp., description, 851.
Phyllophaga anxia, control, Mass., 850.
Phyllosticta glaucispora, notes, 841.
Phyllotoma nemorata and *Phlebatrophia mathesoni*, synonymy, 661.
Phyllotreta on cruciferae, biology, 854.
Phymatotrichum omnivorum—
control, 745.
prolonged saprophytic stage, U.S.D.A., 446.
Physalospora malorum, notes, 244.
Physics of the air, treatise, 204.
Physiology, human, studies in, 491.
Physokermes abietis, notes, Mich., 450.
Phytomonas vignae, notes, Mich., 448.
Phytomyza spp., parasites of, 856.
Phytonomus posticus. (*See* Alfalfa weevil.)
Phytophaga destructor. (*See* Hessian fly.)
Phytophthora—
faberi on cacao pods, pathogenicity of strains, 847.
infestans on tomato, 845.
richardiae n.sp., notes, 46.
sp., notes, 842.
spp., notes, Calif., 841.
Picric acid purification for creatinine determination, 807.
Pieris brassicae, biological and histological studies, 357.
Pigeons—
hybrid, unequal sex ratios in, Wis., 123.
susceptibility, 372.
Pigs—
blood formation, effect of ultra-violet radiation, 861.
breeding systems, Iowa, 364.
breeds, metabolism of, 260.
carcass efficiency test, Ind., 363.
energy and protein requirements, Ill., 461.
experiments at Beltsville farm, summary, U.S.D.A., 457.
experiments with, Oreg., 60.
fall, community hog house *v.* portable cot for, Mich., 460.
fall, effect of sunlight and cod-liver oil, 666.
fattening, 257.
fattening, new standard for, Iowa, 860.
feeding experiments, Calif., 862; Ga., 161; Ind., 363; Kans., 162; N.C., 762; N.J., 761; Nebr., 860; Ohio, 463; Oreg., 61; S.Dak., 61; U.S.D.A., 760, 761; W.Va., 162, 163.
(*See also* Sows, brood.)
inbreeding experiments, Ohio, 430.
individual feeding for comparative feeding trials, 559.
market, production, Minn., 60.
marketing by trucking in, Ind., 863.
nutritional diseases, 70.
on pasture, supplements for, Iowa, 364.
pasture values and pasture methods, Kans., 158.
production, birth weight factor in, Wis., 168.

Pigs—Continued.
production for bacon in Sweden, 261.
production, variation in profits, Iowa, 886.
raising, two-litter system, Ind., 380.
rations, mineral deficiencies, 70.
reproduction as affected by restricted quarters, 257.
suckling, effect of ultra-violet light, 257.
type, relation to gain and pork quality, Ill., 763.
type studies, Ill., 460; Iowa, 364.
(*See also* Sows *and* Swine.)
Pimiento peppers, culture and handling, Ga., 38.
Pine—
beetle, southern, studies, U.S.D.A., 757.
blister rust. (*See* White pine blister rust.)
chir, forests, slash in, 532.
damage by red squirrels, 647.
fruit cast, studies, 349.
jack, length of tracheids in, Minn., 43.
jack, thinning, 235.
jack, yield in Lake States, Wis., 646.
leaf scale, studies, 250.
lodgepole, reproduction in Rocky Mountains, 142.
moth, new injurious, 550.
moths, new, from Japan, 357.
mountain, cone and seed study, 740.
nursery stock, production in the South, U.S.D.A., 341.
red, light requirements, 42.
region, Sierra, logging studies, Calif., 840.
southern, planting, U.S.D.A., 532.
species resistant to blister rust, U.S.D.A., 61.
trees, tapping for naval stores, U.S.D.A., 443.
western yellow, adaptation to heavy soils, Kans., 141.
western yellow, modification of root systems, 740.
wood lignin, 202.
(*See also* White pine.)
Pineapple—
bran, cane molasses, and barley, comparative feeding value, 666.
bran, feeding value, 262, 666.
roots, Scolopendrellidae attacking, 850.
Pineapples, ripening with ethylene gas, Minn., 39.
Pines, southern, mycorrhiza on, 819.
Pines, value, Mich., 740.
Pink bollworm. (*See* Bollworm, pink.)
Pinus merkusii, distribution and growth, 43.
Pipe flow measurement by coordinate method, 378.
Piricularia oryzae, studies, 842.
Piricularia spp., notes, 539.
Piroplasma bigeminum, transmission by ticks, 175.
Piroplasmoses of Algeria, relation to ticks, 175.
Piroplasmosis of cattle in Hokkaido, 678.
(*See also* Texas fever.)
Pissodes strobi. (*See* White pine weevil.)
Pistacia, self- and interfertility of, 215.
Pituitrin and insulin, interaction, 567.
Pityokteines sparsus, notes, Mich., 450.
Pityophilus, new genus, erection, 662.
Pityophthorus, new genus and new species, revisional study, 359, 661.
Placental extract, effect on mammary glands of male guinea pigs, 681.
Plague, bubonic, relation to ships' rats and fleas, 543.
Plant—
breeding activities at Vineland, Ontario, 527.
breeding, disease resistant varieties, 327.
breeding in India, 518.
breeding in Uruguay, 825.
breeding work, review, S.Dak., 517.
bug injury to fruits, Conn.State, 547.
cankers, relation to animal and human cancers, 46.
cell membranes, acids in, 815.
cell wall, chemistry, 815.
cells, food storage in, 23.
cells, protoplasmic layers in, studies, 625.
cells, resistance to insect injury, Kans., 153.
(*See also* Cells.)
chromosomes. (*See* Chromosomes.)
compounds, structure and solubility, 625.
cuttings, rooted, pruning studies, Calif., 337.
diseases—
control, 841; N.J., 741; Va., 745; Wis., 147.
control, dust v. liquid sprays, 354.
handbook, 532.
of New Jersey, annotated lists, N.J., 742.
studies, 841.
virus, new, Utah, 44.
(*See also* Fungi *and different host plants*.)
food, leaching through soil, Va., 718.
growth—
and soil reaction, 719.
diurnal variations in, 817.
effect of change of reaction with ammonium salts, 516.
effect of climatic and environmental factors, Mich., 428.
effect of crude petroleum, 817.
effect of radiations from quartz mercury vapor lamp, 515.
effect on microorganisms in soil, 509.
electric stimulation, 426, 427.

Plant—Continued.
growth—continued.
elements required in small quantities, 817.
relation between top and root size, 522.
relation to potassium concentrations, 319.
rôle of mycorrhiza in, 514.
studies with Lemna, 23.
hybrids with same chromosome numbers as parents, cytology, 216.
inspection. (*See* Nursery inspection.)
Introduction Gardens, Canal Zone, report, 529.
lice, evolution of cycles and origin of heteroecy, 550.
membrane, isolated living, permeability, 212.
nutrients, mineral, availability relation to degree of dispersion, 504.
nutrition, studies, Kans., 117.
parasites, moisture and temperature relations, Wis., 147.
pathology and physiology, relation to man, 741.
pathology and therapy, treatise, 532.
pests, control, patents relating to, U.S.D.A., 543.
physiology and pathology, relation to man, 741.
protection, treatise, 343.
quarantine and control administration, activities, U.S.D.A., 740.
residues and decomposition in soil, N.J., 713.
Sciences, International Congress, papers, 327.
stem tissue reactions, 211.
successions, studies, N.C., 721.
tissue fluids, iron in, N.J., 718.
tissues—
aluminum in, 589.
chemical analysis, 18.
H-ion concentration, 211.
ionic relations, application of Donnan equilibrium to, 308.
succulent, regulation of pH, 212.
world, evolution of substances in, treatise, 625.
Plantain—
disease, notes, 648.
diseases in British Guiana, 654.
Plants—
action of carbon disulfide on, 213.
American, for American gardens, 530.
and soil relations at and below wilting point, Ariz., 619.
and soils, interrelation, 504.
boron and zinc requirements, 28.
cultivated, origin, 327.
decomposition, behavior of lignin in, 808.
effect of stimulation, 516.
fertilizer requirements, determination, 18.
Plants—Continued.
grown in dry or in moist air, peculiarities, 424.
host, and parasites, summary, 582.
imported, U.S.D.A., 24, 325.
nitrogen metabolism, effect of deficiencies, 328.
nursery, hot-water treatment, 546.
ornamental, diseases, Miss., 445; N.J., 743.
ornamental, for home grounds, Va. Truck, 740.
ornamental, phenological data, N.J., 783.
permeability. (*See* Permeability.)
poisonous to livestock, Utah, 69.
(*See also* Livestock poisoning *and specific plants.*)
pollination. (*See* Pollination.)
respiration. (*See* Respiration.)
sap ascent in, method for tracing, 627.
starting inside for earliness, Okla Panhandle, 37.
starting under glass, treatise, 522.
stimulation in, 626.
tolerance to naphthalene, 545.
transpiration. (*See* Transpiration.)
tropical, respiration studies, 816.
variegated, studies, 214.
wilting, relation to foliar water content, 627.
woody. (*See* Woody plants.)
wound hormones in, 514.
X-ray stimulation, 213.
(*See also* Flora *and* Vegetation.)
Plasmodiophora—
brassicae. (*See* Cabbage clubroot.)
tabaci, rôle in tobacco mosaic, 242.
Platyedra gossypiella in the Punjab, 253.
Platymetopius—
frontalis, notes, N.J., 751.
hyalinus, introduction and distribution, 249.
Platynota chiquitana, notes, Calif., 351.
Plectospira gemnifera n.sp., description, 237.
Plesiocoris rugicollis, control, 356.
Pleuropneumonia in cattle—
antigen for complement fixation test in, 570.
diagnosis, 372.
morphological study of virus, 675.
studies, 372, 870.
Plodia interpunctella. (*See* Indian meal moth.)
Plow, stubble, power consumption, 682.
Plowing, tractor. (*See* Tractor plowing.)
Plowing types and costs, Pa., 777.
Plum—
aphid, mealy, control, Calif., 352.
curculio in apple orchards, control, Conn.State, 359.
curculio in apples, life history, habits, and control, Mass., 454.

Plum—Continued.
- curculio, spraying recommendations, Mass., 849.
- kernels, carbohydrate changes in, Calif., 335.
- pollen handling for long distance shipment, 527.
- pollen viability, 527.
- seedlings, studies, N.Y.State, 524.
- stocks for peaches, graft affinity tests, 284.
- tree borer, notes, S.Dak., 53.
- trees, caterpillar enemies in France, 658.

Plums—
- culture experiments, N.Dak., 735.
- effect of iron sulfate, Calif., 342.
- fruitfulness in, 526.
- new seedling, Iowa, 338.
- notes, Miss., 439.
- pollination studies, 526; Mich., 230.
- spray schedules for, W.Va., 442.
- varieties, N.H., 139; N.Y.State, 340.
- variety tests, N.Dak., 735; N.Mex., 738.
- worm pests of, 658.
- yields, Kans., 138.

Plutella maculipennis. (*See* Diamond-back moth.)

Pneumonia—
- among children, relation to nutrition, 392.
- progressive, of sheep, Utah, 69.
- (*See also* Pleuropneumonia.)

Pnyxia scabiei, notes, 554; Ohio, 450.

Poa bulbosa, studies, 224.

Podosphaeras in Pomaceae, biology and classification, 215.

Podsol soils in Quebec, characteristics, 206.

Poecilogonalos thwaitesii, biological studies, 557.

Poecilus lucublandus, notes, Mich., 359.

Poison bait, use for cutworms and grasshoppers, Mich., 450.

Poisonous plants. (*See* Livestock poisoning, *Plants, poisonous, and specific plants.*)

Polistes hebraeus, notes, 357.

Pollen—
- cytology and germinability in small fruits, 427.
- handling for long-distance shipment, 527.
- tube growth and sterility in Datura, 24.
- tube growth at various temperatures, 214.
- tubes in self and cross pollination, behavior, 427.
- viability and fertility in fruits, 526.

Pollination—
- and fertilization of celery, 427.
- problem in fruits and nuts, 526.
- self, of staminate plants, progeny resulting, 428.
- studies in New York State, 643.
- studies of fruits, 428.
- (*See also specific plants.*)

Polychrosis viteana. (*See* Grape berry moth.)

Polyporus annosus on conifers, results, 542.

Polystictus spp., notes, U.S.D.A., 143.

Polythionic acids, toxic factors in sulfur, Ohio, 444.

Pomace flies—
- duration of life, effect of temperature, 358.
- notes, Calif., 659.
- variation in mutation rate, 218.

Pomegranate, vitamin C in, 595.

Pontia brassicae control, 354.

Pop corn downy mildew, notes, Iowa, 344.

Pop corn, variety tests, Kans., 125.

Popillia japonica. (*See* Japanese beetles.)

Poppies, Iceland, wilt affecting, 347.

Poppy, Mexican, feeding tests, 71.

Population of New England, American Geographical Society's studies, 283.

Pork—
- antineuritic value, 390.
- cost and value, effect of type and grain ration, Ohio, 463.
- cuts, relative economy, Ill., 691.
- cuts, selection and use, Minn., 789.
- cuts, yield, factors affecting, 257.
- production. (*See* Pigs.)
- quality, relation to type of pig, Ill., 763.
- quality, studies, Ga., 161.
- soft, avoiding with soybean ration, S.Dak., 61.
- vitamin B in, 390.

Porthetria dispar. (*See* Gipsy moth.)

Porto Rico Station, notes, 200.

Postharmostomum hawaiiensis n.sp., description, 573.

Pot, double-walled, for automatically watering plants, description, Ohio, 444.

Potash—
- effect on cotton wilt, Miss., 446.
- from alcohol manufacture, Md., 321.

Potassium—
- concentrations, relation to optimum plant growth, 319.
- deficiency, effect on metabolism in plants, N.H., 116.
- effect on peat soil, Oreg., 20.
- experiments with tobacco, Conn.State, 134.
- in cell sap, Mich., 418.
- in plant solutions, determination, 13.
- nitrate, preparation, 814.
- requirements of tomato plants, 320.

Potato—
- beetle, Colorado, notes, Idaho, 848.
- beetle, Colorado, septicemia of, 358.
- blackleg, studies, Kans., 146, 149.
- canker, studies, 537.
- diseases—
  - and protection, 841.
  - degeneration in the phloem, 538.
  - degeneration, studies, Nebr., 841.
  - seed-borne, control, Nebr., 640.
  - studies, Ohio, 446.

Potato—Continued.
diseases—continued.
tuber-borne, control, Mich., 443.
virus classification, Wis., 537.
virus, identification, 47.
virus, rate of spread in western Nebraska, 651.
virus, studies, Oreg., 43.
virus, transmission experiments, 651.
early blight, control, Mich., 746.
hollow heart, control, Mich., 746.
hybrid, characteristics, 723.
leaf roll, studies, 241, 537, 651; Mich., 838.
leafhopper injury to forage crop legumes, 649.
leafhoppers, control, 548; Mich., 746.
mosaic, studies, 241, 537; Idaho, 838.
net-necrosis, studies, Vt., 48.
plants, effect of potash deficiency, Miss., 486.
psyllid yellows disease, notes, Utah, 45.
Rhizoctonia disease, control, 538; Kans., 145, 149; Wis., 147.
Rhizoctonia disease, factors affecting, N.J., 741.
scab, control, Kans., 145, 149; Miss., 445; N.J., 742; Nebr., 840; Wis., 147.
scab gnat, notes, 554; Ohio, 450.
spindle tuber, studies, Idaho, 838; Kans., 146.
starch, stiffness in fabrics produced by, U.S.D.A., 497.
tuber diseases, control, Idaho, 823.
tubers, rest period, 720.
unmottled curly dwarf, description, Nebr., 841.
virus, jimson weed as carrier, Ind., 342.
virus on peppers, 846.
Potatoes—
breeding experiments, Oreg., 26; Utah, 27; Va., 726.
breeding methods, Minn., 722.
breeding of immunity in, 651.
change in ash content during storage and cooking, Kans., 190.
cost of production, N.H., 180, 885; N.J., 781.
culture experiments, N.C., 725.
deterioration, cause, N.H., 150.
duty of water experiments, Oreg., 27.
effect of wide spacing and abundant water, Mich., 424.
effect of X-rays on tuberization, 628.
fertility maintenance for, Md., 622.
fertilizer experiments, N.C., 715, 812; N.H., 126; Oreg., 26; Va., 716.
field plat technic, 635.
harvesting, labor requirements, Pa., 777.
hill selection, value, Idaho, 823.
home grown, use, N.H., 180.
Potatoes—Continued.
improvement, N.Dak., 726; Nebr., 824.
in storage, shrinkage, Md., 224.
irrigation experiments, Utah, 27.
late-crop, marketing, U.S.D.A., 187.
paper mulch experiments, 228; Ohio, 440.
potash fertilization and culinary value, R.I., 635.
potassium requirements, Wis., 118.
production for certified seed, N.Dak., 729.
raw, feeding value, Idaho, 865.
rotation experiments, U.S.D.A., 724.
seed, certification in Pennsylvania, 224.
seed, certified, from New Jersey, tests, N.J., 742.
seed, cutting and planting tests, Oreg., 26.
seed, development of strains, Mich., 33.
seed, effect of X-rays, 827.
seed, free from virus diseases, production, 47.
seed, productivity, factors affecting, 224.
seed, sprouting, Ohio, 82.
seed treatment experiments, N.Y. State, 446.
seed, weight losses and vitality, effect of storage temperature, U.S.D.A., 635.
seeding experiments, N.C., 725; N.J., 724.
selection in inbred lines, Minn., 722.
spraying and dusting, N.Y.State, 154.
spraying experiments, N.J., 742.
storage experiments, Idaho, 830; N.C., 725.
stored, diseases attacking, 842.
strain tests, N.C., 725.
variety tests, Idaho, 823; Mich., 432; Miss., 432, 433; N.Dak., 726; U.S.D.A., 724; Va., 726.
vitamin C in, Idaho, 896.
Welsh seed, tests, 29.
yields, relation to soil type, 224.
Poultry—
air requirements, Iowa, 377.
breeding and production, treatise, 560.
breeding, line breeding program, Iowa, 464.
certification, N.H., 262.
club members, manual, Ill., 190.
cold storage, U.S.D.A., 787.
Congress, World's, notes, 100.
cost of production studies in California, 85.
culling, Kans., 464.
culling and selecting for egg production, 669.
Days, programs, Ohio, 62.
dictionary, 865.
disease, new, due to filter-passing virus, 275.
disease, new in Egypt, 572.

Poultry—Continued.
disease organisms, viability, relation to soil reaction, N.J., 769.
diseases, 70; Mich., 468; Ohio, 473.
diseases, histopathology, Kans., 172.
diseases, relation to soil reaction, diagnosis, N.J., 769.
diseases, terminology, 70.
(*See also specific diseases.*)
early hatching, effect on profits and egg size, 669.
economic research in, 283.
epizootic disease in Dutch East Indies, 74.
equipment, new, Ohio, 79.
experiments at Beltsville farm, summary, U.S.D.A., 457.
feeding, all-mash v. grain and mash methods. Ind., 366.
feeding experiments, 667; Calif., 364; Ind., 365; S.Dak., 62; Utah, 63; Wis., 164.
fertility in, 668.
house, adaptable, and range shelter, Ohio, 179.
houses—
lighting, arc lamps v. Mazda lamps, Oreg., 74.
plans and construction, Ill., 179.
temperature, relative humidity, and air movements, Ind., 377.
ventilation and construction, Nebr., 877.
ventilation and temperature, effect on hens, 258.
infection with *Brucella abortus*, Mich., 875.
inheritance of down color and of down on toes, Kans., 124.
inheritance of ear lobe color, Kans., 124.
leg weakness in, 474.
lice in Hawaii, 856.
lice, mites, and other pests, control, N.J., 451.
lice, nicotine sulfate painted on roosts for, Calif., 352.
live, wholesale marketing in New York City, U.S.D.A., 485.
management and cost of production, N.Mex., 261.
mortality, causes, N.C., 175.
nutritional leg weakness in, 667.
outlook chart, U.S.D.A., 887.
parasites, intestinal, control, 573.
parasites, summary, Nebr., 175.
pathology, survey, 70.
plumage characterization relation to gonadic structure, 680.
products, White Mountain demand for, N.H., 885.
profits, causes of differences in, Mass., 784.
raising experiments in Palestine, 63.
raising in confinement, Ohio, 667.
raising, treatise, 667.

Poultry—Continued.
round worm, large, summary, 875.
Science, papers published in, review, N.J., 62.
standardization, progress in, 688.
treatise, 865.
(*See also* Chickens, Ducks, Fowls, *etc.*)
Powder-post beetles, life history and habits, 855.
Power and labor requirements of agriculture, Pa., 777.
Power and machinery, studies, Mich., 475.
Prairie grass, cutting experiments, Kans., 125.
Precipitation, relation to stream discharge, Utah, 75.
(*See also* Rainfall, *etc.*)
Preen gland of fowls, relation to rickets, 864.
Pregnancy disease of sheep, Ky., 873.
Price index, farm real estate, Mich., 286.
Prices, index numbers, Ohio, 181, 482, 684, 883.
Prices, stabilization, and farmer's income, 284.
Privet tineid, morphology and biology, 550.
Prodenia litura, control, 658.
l-Proline, pure, isolation, 307.
Propionic acid-producing bacteria, studies, Wis., 107.
Prosthogonimus putschkowskii life history, 574.
Protein—
foods, iron utilization in, 257, 791.
intake effect on reproduction, 591.
supplements for calves, Ohio, 858.
supplements for hens, S.Dak., 62.
supplements v. minerals for fattening pigs, N.C., 762.
Protein-lipin complexes, studies, 306.
Proteins—
action of lactic and butyric acid bacteria on, Wis., 107.
denaturation, 409.
digestibility determination, Bergeim's method, 613.
in animal products, growth values, 63.
in blood, precipitant for, 807.
in dairy rations, requirements, Ohio, 465, 466.
in diet, calculation, U.S.D.A., 191.
in ration, effect on development of internal organs, Calif., 360.
in wheat, effect of nitrates in soil, Utah, 28.
in white wheat, relation to texture, Mich., 731.
injury to kidneys, 389.
of helminths, 174.
of serum, ultra-violet absorption curves, 306.
physiological effects, 389.
progressive seasonal changes in plants, Mich., 424.

-Continued.
ion to hemoglobin production in
s, 193.
val from blood plasma, method,
3.
dine and tryptophane in, deter-
nation, 807.
:able, studies, 291.
m—
chloroplasts in *Bryopsis plumosa*,
8.
g, penetration of carbon dioxide,
3.
ant cells, drying capacity, 518.
eability of, 212.
sity in, 120.
microphotographic atlas, 720.

ack, control, Calif., 342.
, bearing and nonbearing, chemi-
l changes in, Calif., 335.
a, notes, Idaho, 848.

)osition and food value, Oreg.,
2.
dration, Oreg., 74.
l, grading, Oreg., 738.
esting and handling studies, Oreg.,
i.
dardization, Oreg., 85.
ige experiments, Idaho, 831.
in confections, Oreg., 89.
sinica, life history, 851.
ccus—
. (*See* Citrus mealybug.)
stocki, notes, Va., 752.
ni control, Calif., 350.
ni, parasites, 758.
owlpest, proposed name, 74.
onas pisi, studies, 240.
ronospora cubensis, notes, Mass.,

lenomus pachycoris n.g. and n.sp.,
ption, 856.
sae. (*See* Carrot rust fly.)
iola haemorrhoidalis, notes, Mich.,

pyricola. (*See* Pear psylla.)
s affinis, transmission experiments
virus diseases, 651.
health relation to fatty foods, 390.
—
iariae, notes, 841.
mata avenae, physiologic specializa-
ion in, 343.
mata on oats, cytological study,
39.
narum, notes, Idaho, 839.
minis tritici, color mutations in,
37.
roeteri, notes, 849.
ght on corn, nature of resistance to,
85.
., infection conditions, 584.
., notes, 445.

Pullets—
body size relation to size of eggs, 669.
protein requirements, Ind., 365.
raising, N.J., 367.
(*See also* Chickens *and* Poultry.)
Pullus sp., notes, Calif., 851.
Pulp-timber resources of southeastern Alaska, U.S.D.A., 42.
Pulses, Indian, studies, 222.
Pulvinaria vitis. (*See* Maple scale, cottony.)
Pumping plants, irrigation, design, Colo., 276.
Pumpkins—
and squashes, crossing experiments, Iowa, 339.
as sugar plant in Russia, 828.
Phytophthora citrophthora affecting, Calif., 341.
Purdue University, notes, 395, 598.
Pyobacillosis of sheep, 374.
Pyralinae, Japanese, paper on, 55.
Pyrausta—
ainsliei, life history studies, Iowa, 354.
nubilalis. (*See* Corn borer, European.)
penitalis, life history studies, Iowa, 354.
Pyrethrum—
insecticidal value, 849; N.J., 751.
soaps, insecticidal value, Md., 655.
tests, 354; Hawaii, 723.
white oil extract, insecticidal value, N.J., 750.
Pyrophosphoric acid, separation and determination, 501.
Pythiacystis citrophthora mycelium, enzymes of, 237.
Pythium—
aphanidermatum, notes, 45.
debaryanum pelargonii, notes, 46.
intermedium, notes, 46.
irregulare n.sp., description, 46.
megalacanthum, notes, 46.
splendens, notes, 46.
Quack grass, control, Mich., 34; Miss., 436; Ohio, 640.
Quail as source of tularemia in man, 871.
Quarantines and work of Kansas Entomological Commission, 354.
Quince fire blight, overwintering and modes of infection, Mich., 448.
Quinces, varieties, N.Y.State, 340.
Quinhydrone electrode—
accuracy, effect of manganiferous soils, 208.
drift in potential, Ohio, 418.
for pH determinations, 309.
rôle in determining keeping qualities of milk, Mass., 867.
Quinine—
adsorption by fuller's earth and norit, 12.
nephelometric determination, new reagent, 204.
Rabbit semen, pH value, 821.

Rabbits, protection of fruit trees from, Ohio, 836.
Rabies, control in Japan, 872.
Rachitic rats, resistance to infection, effect of sunlight, 595.
Radiations from quartz mercury vapor lamp, effect on plants, 515.
Radio high frequency waves, effect on insects, 655.
Radiomorphosis, use of term, 515.
Radishes—
change in ash content during storage and cooking, Kans., 190.
effect of potassium deficiency, N.H., 116.
top-root ratio, studies, 522.
yields under ultra-violet glass, 834.
Rain forest in Panama, general and successional ecology, 531.
Rainfall—
effect on sirup production in sorgo, Ark., 828.
of northern New England, tables, 205.
on valley floors, water supply from, 475.
(See also Precipitation.)
Ramie, fiber-yielding plant, U.S.D.A., 729.
Rams of six breeds for siring market lambs, comparison, 259.
Rams, Romney, analysis of fleeces, Calif., 260.
Ranch organization and operation in northern Great Plains, U.S.D.A., 581.
Range—
plants not poisonous to livestock, U.S.D.A., 70.
plants, poisonous. (See Plants, poisonous, and Livestock poisoning.)
reseeding tests, Utah, 27.
resources of San Luis Valley, Colo., 512.
Rape and alfalfa pasture for pigs, Mich., 459.
Rape pasture for pigs, Oreg., 61.
Raspberries—
canning quality, Oreg., 36.
hardiness, N.Dak., 735.
harvesting and handling studies, Oreg., 35.
insects as aid to fruit setting, Mich., 41.
marketing, Minn., 85.
production, Mo., 836.
Van Fleet, notes, Miss., 438.
variety tests, Ga., 136; N.Dak., 735.
Raspberry—
anthracnose, control, N.J., 741.
cane spot, control, 846.
crown borer, studies, N.J., 758.
crown gall, studies, Wis., 148.
Gloeosporium blight, 848.
mosaic tissue, intracellular bodies in, 848.
orange rust, notes, Mich., 449.
plants, selected, value, Mich., 498.
Verticillium wilt, notes, Oreg., 44.
Rat flea survey of port of Norfolk, 660.
Rat fleas of ships, relation to bubonic plague, 543.
Rat-moles, Bosnian-Hercegovinian, studies, 449.
Rats—
at different ages, iron in, 790.
growth and reproduction on vitamin C-free diet, 194.
growth, food requirements, 597.
nursing young, vitamin B requirements, 696.
of ships, relation to bubonic plague, 543.
stock albino, improved growth rate, 694.
toxicity of hydrocyanic acid for, 650.
(See also Rodents.)
Rayon, identification, 96.
Rayon yearbook, 96.
Reclamation projects, relation to agricultural depression, 285.
Recurvaria condignella n.sp., description, 550.
Red mite—
as parasite of field cricket, U.S.D.A., 754.
European, biology, U.S.D.A., 157.
European, control, Mass., 848.
European, notes, Ohio, 450.
European, overwintering eggs, combined sprays for, N.J., 452.
Red scale, control, 755.
Red spider—
control, 546.
greenhouse, studies, Mass., 849.
injury to deciduous fruits, Calif., 351.
notes, Ohio, 450.
studies, Oreg., 53.
Redwater. (See Texas fever.)
Redwater, Rhodesian. (See African coast fever.)
Reed canary grass as hay and pasture crop, Minn., 331.
Refection in rats, 594.
Refrigeration—
and biology, 528.
electric, in farm homes, N.H., 897; Nebr., 898.
Reindeer diseases and care, 472.
Rejection evil, paper on, 688.
Religion and the farmer, papers on, 579.
Religious organizations, young people's, Va., 788.
Reproduction, effect of protein intake, 591.
Research—
and the Agricultural Marketing Act, editorial, 301.
institute on rural affairs, conference on, 285.
tabulation machine, notes, 299.
Respiration—
of bananas during ripening, effect of ethylene, 517.
of leaves of *Artocarpus integrifolia*, seasonal variations, 816.

Respiration—Continued.
of plants, cell for continuous measurements, 24.
of sorghum grains, U.S.D.A., 33.
of tree roots, apparatus for study, 524.
Respiratory quotient in health and disease, 591.
Rhagoletis—
cingulata. (*See* cherry fruit fly and Cherry maggot.)
juglandis, notes, Calif., 850, 659.
juglandis, studies, 255.
pomonella. (*See* Apple maggot.)
Rhipicephalus—
appendiculatus, longevity, 69.
bursa, transmission of piroplasmosis by, 175.
Rhizoctonia—
damping-off of conifers, control, N.Y. Cornell, 748.
of potatoes, control, Kans., 145, 149.
of potatoes, factors affecting, N.J., 741.
of potatoes in Idaho, seed treatment, 538.
Rhizoctonia solani, notes, 842; Mass., 840.
Rhizopus as starch transformers, new species, 214.
Rhizopus nigricans, notes, N.C., 745.
Rhode Island College, notes, 200.
Rhode Island Station, notes, 99, 599, 900.
Rhode Island Station, report, 699.
Rhododendron disease, notes, 841.
Rhododendron diseases, studies, N.J., 743.
Rhododendrons from seed, U.S.D.A., 739.
Rhopobota naevana and *vacciniana*. (*See* Fire worm, blackheaded.)
Rhubarb crown rot, notes, Tenn., 146.
Rhynchites bicolor. (*See* Rose curculio.)
Rhynchocoris humeralis on citrus, 753.
Ribes, genus, hybridization in, 429.
(*See also* Currants *and* Gooseberries.)
Rice—
blast, studies, 538, 842.
borer, notes, 357.
breeding experiments, 330.
culture experiments, 330.
curing, irrigation, and seed viability studies, 330.
descriptive terms, standardizing, 520.
drying, studies, Calif., 376.
effect of sodium chloride, 719.
fertilizer experiments, 330; Tex., 729.
hybridization in California, technic, 225.
insects, distribution in Japan, 753.
insects in Japan, zonal distribution, 758.
irrigation, studies, Calif., 376.
kept four years in zinc containers, germinating power and nutrients in, 895.
leaf spot, in Pacific regions, 539.
milling tests, 320.
polishings, extract, antineuritic properties, destruction, 293.
polishings, vitamin B in, 895.
Rice—Continued.
soil, effects of cropping for a long period, 511.
starch, stiffness in fabrics produced by, U.S.D.A., 497.
storage in carbon dioxide and airtight containers, effect, 520.
variety tests, 330.
Rickets—
as secondary manifestation in coccidiosis, 678.
experimental, intestinal pH in, 94.
experimental, tetany of fasting in, 495.
in birds, relation to preen gland, 864.
in chickens, ultra-violet wave lengths for, 865.
in swine, 257.
infantile, prevention by irradiation, 94.
prevention, cod-liver oil v. ultra-violet light, 294.
prophylaxis, 95.
quartz lamp therapy in, 896.
treatment with irradiated ergosterol, 596, 795.
Rickettsia diseases in tropics and filtrable virus, 269, 568, 871.
Rinderpest—
benign inapparent form, 871.
immunization, use of goat virus, 673.
in Egypt, 871.
prophylactic inoculation, 372.
studies, 267.
vaccine, experiments, 568.
Rio Grande National Forest, Colorado, features, U.S.D.A., 42.
Road, Bradley Lane experimental, U.S.D.A., 78.
Roads—
concrete. (*See* Concrete.)
design, effect of increased speed of vehicles, U.S.D.A., 177.
interrelationship of load, road, and subgrade, U.S.D.A., 477.
Roadside plan and progress in Massachusetts, U.S.D.A., 878.
Robins, new gapeworm from, 574.
Rock phosphate. (*See* Phosphate.)
Rock products as mineral supplements, 257.
Rocky Mountain spotted fever, papers on, 656.
Rodenticides, composition, Conn.State, 355.
Rodents, injurious, control, Kans., 153.
(*See also* Mice *and* Rats.)
Roentgen rays. (*See* X-rays.)
Root—
crops, tests, Utah, 27.
crops, varieties, Oreg., 26.
crops, variety tests, Mich., 432.
hairs, growth in solutions, 626, 816.
maggots, notes, Mich., 450.
nodules. (*See* Nodule bacteria.)
rots caused by Phycomycetes, 46.
systems, development, effect of light relations, 424.

Roots—
cell division and elongation in, 626.
development and soil moisture, Calif., 620.
of perennial weeds, winter activity, 626.
Rose—
bug, control, N.J., 750.
chlorosis, notes, N.J., 744.
curculio, notes, Mich., 450.
Roses—
breeding experiments, S.Dak., 39.
culture in Bulgaria, 837.
in storage, control of molds on, N.J., 743.
propagation, Va.Truck, 740.
stocks for, Tenn., 140.
wild, cytological conditions and evidences for hybridity, 217.
Rosy rustic moth as hop pest, 354.
Rotation of crops, Kans., 116; Miss., 433; N.C., 715, 725; N.Dak., 726; Nebr., 824; Oreg., 26; Tenn., 127; Utah, 27; Va., 716, 727; W.Va., 518.
Rotation of crops during drought, Okla. Panhandle, 825.
Rotation of crops, suggestions for, Iowa, 884.
Rotenone, insecticidal principle of Derris, 543.
Roughage—
and grains, mixing for cows, Ohio, 465.
chopped and grain, mixed v. unmixed, Ohio, 457.
chopping v. grinding, Ohio, 457.
grinding for dairy cows, S.Dak., 66.
Roundworms in poultry, control, Ill., 772.
Roup, immunity, relation to vitamin A in feed, Kans., 164.
Roup in pigeons, control, Calif., 370.
Rubber latex, total solids in, determination, 809.
Rubus, variety tests, Ga., 136.
Run-off and erosion experiments in Texas, 574.
Run-off of Logan River, relation to snow cover, Utah, 75.
Rural—
affairs, research institute on, conference on, 285.
church, Va., 788.
church and cooperative extension work, U.S.D.A., 87.
community halls, establishing and financing, Mont., 690.
credit. (See Agricultural credit.)
education, decade of progress, 579.
government, 579.
health and sanitation, 579.
high school graduates, migration to city, Mich., 787.
homes, fuels for cooking in, Ind., 894.
homes, papers on, 579.
human relationships, science in, 579.
labor. (See Agricultural labor.)
Rural—Continued.
libraries, in Montana, Mont., 488.
life in Tennessee, effects of industrial development, 886.
life survey of Vermont, 283.
participation in organization enterprises, Mich., 787.
population, movement, Ohio, 481.
population, movement to cities, effects, treatise, 385.
population, papers on, 284.
progress in the last decade, 579.
schools. (See Schools, rural.)
social work, papers on, 579.
sociology principles, treatise, 385.
sociology research, Mich., 787; Va., 788.
(See also Community and Country.)
Rust fungi, heterothallism in, 647.
Rust fungi pycnia, function, 648.
(See also specific hosts.)
Rye—
bread, ergot poisoning from, 888.
breeding experiments, N.J., 724.
fertilizer experiments, Va., 716.
glutelins, 801.
hardiness, studies, Kans., 121.
scab, control, Mich., 842.
straw as green manure, R.I., 615.
variety tests, Ind., 329; N.C., 725; N.J., 724; Utah, 27; Va., 726; West. Wash., 29.
winter hardiness, N.C., 725.
winterkilling, Wis., 129.
Ryegrass—
Italian, planted at intervals, germination and yield, 29.
perennial, establishment, effect of seed rate, 29.
Rye-wheat hybrids, multiple kernels in, 217.
Safflower—
breeding experiments, 29.
yield tests, U.S.D.A., 783.
Sahlbergella spp., life history and habits, 450.
Sainfoin in South Wales, 29.
Saissetia scale, moth larvae feeding on, 550.
Sal heartwood borer—
epidemic attacks, 757.
studies, 255.
Salmon oil, antirachitic value, 64.
Salmonella—
aertrycke, heat-killed cultures, fed to animals, effect, 673.
aertrycke infection of canaries, 69.
enteritidis fed to animals, effect, 673.
intoxication experiments, failure in man, 673.
Salmonella pullorum—
in eggs, significance, Pa., 672.
in incubators, formaldehyde gas for, 674.
nodular lesions caused by, 676.
notes, 73; Mich., 469.
(See also *Bacterium pullorum*.)

Salmonella suipestifer—
agglutinins for, 78.
cause of fatal human infection, 372.
Salt concentration and growth, 213.
Salt solutions for wheat growth, toxicity, additive effects, and antagonism, 818.
San Jose scale—
control, Idaho, 848; Kans., 137; N. Mex., 247; Oreg., 53.
efficiency of oil spray for, effect of Bordeaux mixture, Ind., 353.
Sandy soil types, magnesium deficiency in, N.C., 718.
Sap ascent in plants, method for tracing, 627.
Sauerkraut—
homemade, vitamin C in, Wis., 194.
making, gas production in, 712.
Sausage, inspection, Me., 693.
Sawfly, western wheat stem, effect on spring wheat crop in Canada, 452.
Scale insects, bionomics and control, 250.
Scaptomyza graminum, notes, 240.
Schistocerca spp., studies, 54.
Schizoneura lanigera. (*See* Apple aphid, woolly.)
Schoenobius incertellus, notes, 357.
School children, effect of school feeding and transportation, Mass., 891.
Schools—
agricultural. (*See* Agricultural school.)
elementary, school feeding and transportation, Mass., 891.
public, state taxation systems, 287, 883.
rural, curriculum revision, 579.
vocational. (*See* Agricultural education, vocational.)
Sciara larvae control, 354.
Sciara, sex-ratio determination in, 822.
Science and the farmer, 285.
Sclerospora graminicola, notes, Iowa, 344.
Sclerotinia and Monilia species, taxonomic position, 845.
Sclerotinia—
americana, two fungi on apothecia, 848.
cinerea, notes, 848.
fructigena, notes, 653.
libertiana, notes, 841.
Sclerotium—
coffeicolum, notes, 648.
rhizodes, notes, Mass., 840.
rolfsii on peppers, control, Ga., 144.
rolfsii, studies, 650, 651, 842.
Sclerotium disease of tomato and pepper, 651.
Scolopendrellidae, biological notes, 850.
Scolothrips sexmaculatus, notes, U.S.D.A., 157.
Scours in sheep and goats, Oreg., 768.
Scurvy—
experimental, nitrogen balance and C/N coefficient of urine, 296.
metabolism in, 296.
studies, 595.
Scutigerella immaculata—
life history and control, Ind., 663; Oreg., 53.
notes, Ohio, 450.
Scymnus sp., notes, 549.
Sea water, effect on mold in cacao beans, 847.
Seed—
control station, Hungarian, in Budapest, activities, 639.
counter, description, U.S.D.A., 34.
disinfectants, tests, 842.
law of Massachusetts, text, Mass., 334.
treatment tests for cotton, Miss., 446.
treatments of wheat, comparison, Utah, 47.
Seed-corn maggot, notes, Iowa, 353; Kans., 146.
Seedling growth, effect of pH of nutrient solutions, 627.
Seeds—
analysis, Vt., 34.
analysis in Pennsylvania, 334.
germinating fatty, translocation of fats, 323.
germination, effect of crude petroleum, 317.
germination, effect of light of different wave lengths, 515.
germination, effect of temperature alternation, 515.
germination, oxygen-supplying power requisite for, 11.
heating, quickness of killing in, 629.
imported, U.S.D.A., 325.
inspection, Ind., 732; Mass., 334; Me., 226; N.J., 437.
investigation and valuation in German experiment stations, 610.
mixture problems, 518.
packet vegetable, quality, N.Y.State, 441.
weed. (*See* Weed seeds.)
Seius sp., notes, U.S.D.A., 157.
Selection, Haldane's theory, 630.
Self-feeders for calves, S.Dak., 561.
Senecio riddellii, poisoning of horses by, Nebr., 768, 869.
Septicemia, fatal, in man, 372.
Septoria—
chrysanthemella and *Septoria obesa*, comparison, 654.
gladioli, notes, N.J., 748.
graminum, notes, 841.
melissae, notes, 841.
obesa and *Septoria chrysanthemella*, comparison, 654.
Septoria leaf spot on tomato, control, Ind., 342.
Serica similis, distribution and abundance in New York, 556.
Sericulture. (*See* Silkworm.)
Serratia marcescens as indicator of efficient pasteurization of milk, 867.
Serrodes partita, notes, 550.

Serum diagnosis, significance for research in history of descent, 826.
Sesamum, breeding experiments, 29.
Sewage—
disposal, biology, N.J., 780.
disposal for farm homes, Ill., 179.
filter, Dunbar, efficiency, 283.
sludge as fertilizer, 210.
sludge digestion, effect of alkaline substances, N.J., 480.
Sex—
conditions of seedlings from selfed staminate plant, 428.
in asparagus, studies, 523.
in rust fungi, 647.
ratio in chicks, relation to antecedent egg production, 863.
ratio in Sciara, determination, 822.
ratio in Sciara, responsibility of female for, 822.
Sexual maturity in mice, age of, 327.
Sexuality in fungi, 818.
Sheep—
breeding, feeding, and management, treatise, 859.
disease in Chile, studies, 874.
diseases, obscure, 272.
(*See also specific diseases.*)
experiments at Beltsville farm, summary, U.S.D.A., 457.
fattening, Calif., 861.
feeding experiments, Ind., 362.
(*See also* Lambs.)
improvement, Missouri plan, 258.
in Britain, parasite, 272.
industry of Australia and New Zealand, 859.
industry, status, U.S.D.A., 786.
inheritance in, Ohio, 430.
iodine requirements, Iowa, 362.
Merino, inheritance of chalk-face in, 257.
mustard treatment for parasites, 675.
parasitic diseases, Oreg., 68.
parasitic worms in Kenya, 874.
pasture studies, Oreg., 60.
pasture values and pasture methods, Kans., 158.
poisoning by water hemlock, Ohio, 174.
(*See also* Livestock poisoning, Plants, poisonous, *and specific plants.*)
pox and smallpox, etiological relations, 872.
pox vaccine, 571.
production in Alberta, 259.
production in New Mexico, economics of, N.Mex., 284.
stomach worms, control, 874; N.C., 766.
sweetclover for, Ohio, 458.
toxic effect of chemicals used in weed control, Idaho, 874.
water consumption, Oreg., 60.
weedy grasses injurious to, Iowa, 873.
worm parasites, treatment for, Oreg., 768.
Sheets, areas of greatest wear in, 497.
Shelter belt plants, list, U.S.D.A., 783.
Shelter belt trees, N.Dak., 785.
Shelter belts on Iowa farms, value, 581.
Shepherd's purse, species hybridizations, 215.
Shipping associations, cooperative livestock, practices and problems, Ill., 886.
Shrimps, dried, feeding value, 862.
Shrubs—
and trees of New Zealand, how to identify, 531.
chlorosis in, Idaho, 847.
ornamental, list, U.S.D.A., 783.
propagation, U.S.D.A., 441; Va.Truck, 740.
Sidemia devastatrix larvae on corn, 546.
Silage—
and hay v. pasture for cattle, Ohio, 457.
Atlas and Kansas Orange, comparison for milk production, Kans., 167.
corn, feeding to dairy cows, grain losses in, 765.
corn, nitrogen in, effect of nitrogenous fertilizers, N.J., 765.
corn v. sweet sorghum, for milk production, S.C., 67.
cost of production, Oreg., 784.
cutter, field, for corn harvesting, Ohio, 478.
cutting, electric motors for, Pa., 880.
sorghum and guinea grass, comparison, 558.
sorgo, feeding value, Kans., 167.
studies, Kans., 168.
Silk, artificial. (*See* Rayon.)
Silk fabric, weighted, studies, 95.
Silkworm diseases, studies, 55.
Silos, filling with five horsepower electric motor, 881.
Silvanus surinamensis on dried fruit, 850.
Sipha flava, notes, 539.
Sires—
and dams, Ayrshire, progeny performance, Mo., 169.
purebred, for herd improvement, Idaho, 766.
purebred, for producing cattle for market, 257.
Sitophilus granaria. (*See* Granary weevil.)
Skeletal anomalies, human, inheritance, 630.
Skim milk—
cultured, wheying-off properties, effect of viscolization, N.J., 767.
dry, effect of method of manufacture on baking quality, 386.
dry, effect on fermentation and pH of doughs, 586.
drying, Wis., 181.
factory tests, Idaho, 809.
fresh unripened cheese from, 767.
high heat treated, for ice cream, 369.
powder, addition to Cheddar cheese, Idaho, 869.
powdered, for dairy calves, Ohio, 169.

Skin lesions, bovine, studies, 878.
Skin temperature, factors affecting, 591.
Slough grass, notes, Iowa, 354.
Slugs, control, Calif., 352.
Smallpox and sheep pox, etiological relations, 372.
Smartweed borer, life history studies, Iowa, 354.
Snapdragon rust, control, Ind., 342.
Snapdragons, radiomorphosis in, 515.
Snow cover—
amount, relation to survival of grape berry moth, 253.
effect on soil temperature, 808.
Soap, detergent action, 897.
Soap-nicotine preparations, deterioration, 544.
Soaps, pure, effect on bactericidal properties of phenolic germicides, 804.
Sociology, rural, treatise, 385.
Sodium—
benzoate concentration, requirement in fruit preservation, effect of pH, Calif., 387.
benzoate toxicity to microorganisms, effect of pH, 412.
carbonate as herbicide for mustard, strength, N.H., 127.
chlorate, characteristics and use in weed control, Ohio, 640.
chlorate spray for quack grass, Mich., 34.
chlorate substitutes for killing bindweed, 227.
chloride, effect on rice, 719.
citrate use in starter cultures, 564.
effect on properties of ice cream mix, 565.
germanate added to iron, effect on blood regeneration, 590.
hydroxide as herbicide for mustard, strength, N.H., 127.
hypochlorite for sterilizing dairy equipment, 564.
nitrate as herbicide for mustard, strength, N.H., 127.
nitrate, fertilizing value, Iowa, 319.
nitrate, nitrogen availability, factors affecting, N.J., 714.
nitrate treatment of crops, effect of time and rate of application, S.C., 119.
oleate soap, insecticidal value, N.J., 751.
Softwoods, capillary structure, 24.
Soil—
acidity—
and liming, 209; Nebr., 812.
causes, Wis., 114.
Ohio method of testing, 624.
paper on, 827.
physicochemical aspects, Mich., 420, 709.
studies, Oreg., 20.
(See also Liming and Soils, acid.)
Soil—Continued.
analysis, hydrogen peroxide-hydrochloric acid treatment for, 504.
colloids, rôle in moisture equivalent determination, 316.
conditions in Arkansas Valley, Colorado, U.S.D.A., 19.
Congress, International, notes, 100, 800.
consistency, studies, Ohio, 418.
development in San Joaquin family of soils, Calif., 314.
erosion, Federal-State committee, notes, 399.
fertility—
factor in land appraisal, Mo., 883.
Illinois system, Ill, 714.
studies, Ind., 319; Kans., 116; Miss., 436; N.C., 715; Nebr., 811, 824; Oreg., 20; Utah, 19; Va., 716.
studies with conifers, Idaho, 811.
tests, Ill., 423.
filter tubes, repair, 316.
hydromechanics, progress in, U.S.D.A., 77.
insecticides, mercury salts for, 543.
laboratory, portable, 624.
moisture—
and plant relations at and below wilting point, Ariz., 619.
and root development, Calif., 620.
conservation, terracing for, Okla.Panhandle, 77.
effect of alfalfa production, 519.
effect of organic matter and lime, 207.
equivalent, determination, 315.
regulation, U.S.D.A., 77.
relation to drought of 1926–27, Okla.Panhandle, 825.
relation to soil nitrates, Kans., 137.
relation to summer use of land, Okla.Panhandle, 482.
relations, Calif., 314.
report, Okla.Panhandle, 96.
studies in forest area, Ohio, 442.
nitrates, relation to soil moisture, Kans., 137.
nutrients, index, field tests v. Neubauer method, 813.
reaction and plant growth, 719.
reclamation of worn-out and eroded hillsides, Va., 717.
reconnaissance of Palestine, 381.
sampling tube, improved, 503.
science, handbook, 508.
Science, International Congress, notes, 100.
solution, phosphate in, relation to its retention by hydrated alumina, 208.
solution, relation to pH, Kans., 114.
sterilization by forcing steam through tile in greenhouse soil, Ohio, 444.

Soil—Continued.
survey in—
Alabama, Greene Co., U.S.D.A., 421.
California, Auburn area, U.S.D.A., 113.
California, Bishop area, U.S.D.A., 15.
California, Coachella Valley area, U.S.D.A., 206.
Florida, Lake Co., U.S.D.A., 206.
Georgia—
Calhoun Co., U.S.D.A., 17.
Chattahoochee Co., U.S.D.A., 112.
Dooly Co., U.S.D.A., 616.
Fannin Co., U.S.D.A., 809.
Jenkins Co., U.S.D.A., 616.
Lamar Co., U.S.D.A., 17.
Randolph Co., U.S.D.A., 16.
Illinois, Douglas Co., Ill., 809.
Iowa—
Cherokee Co., U.S.D.A., 16.
Clarke Co., U.S.D.A., 206.
Fremont Co., U.S.D.A., 15.
Harrison Co., Iowa, 809.
Jones Co., U.S.D.A., 16.
Plymouth Co., Iowa, 421; U.S.D.A., 206.
Maryland, St. Marys Co., U.S.D.A., 112.
Maryland, Worcester Co., U.S.D.A., 16.
Massachusetts, Berkshire Co., U.S.D.A., 421.
Michigan—
Antrim Co., U.S.D.A., 14.
Barry Co., U.S.D.A., 15.
Hillsdale Co., U.S.D.A., 15.
Isabella Co., U.S.D.A., 14.
Livingston Co., U.S.D.A., 421.
Macomb Co., U.S.D.A., 14.
Muskegon Co., U.S.D.A., 618.
Minnesota, Olmsted Co., U.S.D.A., 111.
Mississippi, Harrison Co., U.S.D.A., 16.
Missouri, Lawrence Co., U.S.D.A., 14.
Montana, Valier irrigation project, Mont., 422.
Nebraska—
Adams Co., U.S.D.A., 617.
Buffalo Co., U.S.D.A., 16.
Butler Co., U.S.D.A., 617.
Garden Co., U.S.D.A., 422.
Kearney Co., U.S.D.A., 206.
Platte Co., U.S.D.A., 617.
Nevada, Las Vegas area, U.S.D.A., 616.
North Carolina—
Camden and Currituck Cos., U.S.D.A., 206.
Greene Co., U.S.D.A., 17.
Sampson Co., U.S.D.A., 206.
Ohio, Lake Co., U.S.D.A., 314.

Soil—Continued.
survey in—continued.
Panama Canal Zone area, U.S.D.A., 113.
Pennsylvania, Lycoming Co., U.S.D.A., 112.
South Dakota, Walworth Co., U.S.D.A., 14.
Tennessee—
Dickson Co., U.S.D.A., 206.
Maury Co., U.S.D.A., 616.
Texas—
Henderson Co., U.S.D.A., 112.
Rockwall Co., U.S.D.A., 616.
Wichita Co., U.S.D.A., 617.
West Virginia—
Mercer Co., U.S.D.A., 206.
Summers Co., U.S.D.A., 617.
Wisconsin—
Monroe Co., U.S.D.A., 616.
Pierce Co., U.S.D.A., 616.
Sheboygan Co., U.S.D.A., 315.
survey reports, 1923, U.S.D.A., 206.
survey, Willamette, meaning and use, Oreg., 423.
technology, Calif., 314.
temperature, daily and seasonal, Calif., 418.
temperature, effect of forest litter, 647.
temperature, effect of snow cover, 808.
temperatures and paper mulches, Calif., 314.
treatment at Germantown, effect, Ohio, 423.
tube jack, description, 504.
types, effect on farm economy, 288.
water. (See Soil moisture.)
Soils—
acid, distribution in Michigan, Mich., 18.
(See also Soil acidity.)
alkali. (See Alkali.)
American, as seen by Russian investigators, 503.
and fertilizers, studies, R.I., 614.
and plants, interrelation, 504.
argillo-humic complex, formation and constitution, 206.
base exchange studies, Calif., 317.
bog. (See Bog soil.)
carbonates in, determination, 418.
Cherokee silt loam, fertilizer requirements, Kans., 117.
deteriorated tropical, effect of lime, 511.
Durham series, studies, N.C., 718.
exchangeable bases, effect of cropping, Calif., 317.
exchangeable cations in, 506.
genesis and classification, climatic factor in, 206.
greenhouse, eradication of nematodes and fungi, Mass., 840.
greenhouse, reaction, 640.
heavy-textured, improvement of permeability, Oreg., 18.

Soils—Continued.
improvement with legumes, Ind., 207.
inoculation. (*See* Legumes, inoculation.)
investigation and valuation in German experiment stations, 610.
leaching of plant food through, Va., 718.
lime requirements, electrometric method for measuring, 203.
lime requirements of Cherokee silt loam, Kans., 117.
microbiological studies, N.J., 713; Oreg., 19.
muck. (*See* Muck soil.)
nitrogen content. (*See* Nitrification *and* Nitrogen.)
of Michigan, Grayling sand type, Mich., 113.
of Michigan, organic matter in, Mich., 18.
of Missouri, Mo., 810.
of Morgan County, Ill., 17.
of Oregon, replaceable bases in, Oreg., 18.
of Oregon, sulfur in and loss through drainage and cropping, 210.
of western Oregon, effect of liming, Oreg., 20.
of Willamette series and utilization, Oreg., 422.
organic matter in. (*See* Organic matter.)
oxygen-supplying power, studies, 11.
peat. (*See* Peat.)
pH determination, methods, U.S.D.A., 12.
replaceable bases, effect of crop growth, 208.
residual effect of alfalfa, Kans., 116.
studies, Ohio, 417.
suction forces in, measurement, 315.
swamp. (*See* Swamps.)
tests, Neubauer v. cornstalk method, Ind., 342.
zeolite, magnesium and calcium in, Ariz., 618.
Soilvita, tests, Iowa, 319.
Solar heaters, *design*, Calif., 779.
Solar water heaters, studies, Calif., 375.
Solenotus viridis, notes, 856.
Solutions, nutrient. (*See* Culture media.)
Sordaria uvicola, notes, 50.
Sorghum—
bacterial stripe disease, notes, 48.
breeding experiments, Kans., 125.
culture experiments, Kans., 125.
diseases, control, Okla.Panhandle, 447.
fields, insect survey, Kans., 152.
grain, breeding experiments, Calif., 328.
grain, effect of time of planting, Calif., 328.
grain, respiration, U.S.D.A., 83.
grain, variety tests, Kans., 125; Miss., 433; N.Mex., 219.
Sorghum—Continued.
kernel smut, control, Kans., 145.
midge parasite, studies, 254.
seed rots, control, Okla.Panhandle, 447.
seeds in storage, insects infesting, Kans., 152.
silage. (*See* Silage.)
smut spores, viability, effect of digestive processes, 445.
smuts, control, Okla.Panhandle, 447.
tassel in corn, inheritance, 122.
vitamin E in, 597.
yields, effect of alfalfa in rotation, Kans., 126.
Sorgo—
as sugar plant in Russia, 828.
for sirup and forage, merits, Ark., 827.
v. kafir for dairy calves, Kans., 167.
varietal standardization and seed selection, U.S.D.A., 729.
variety tests, Miss., 433; N.Mex., 219.
South Dakota College, notes, 599.
South Dakota Station, report, 96.
Sows, brood, winter rations, S.Dak., 61.
Sows on good rations, effect on production, Ind., 363.
(*See also* Pigs.)
Soybean—
bacterial pustule, notes, N.C., 744.
frog-eye leaf spot, N.C., 744.
hay v. alfalfa hay for milk production, Kans., 167.
meal, feeding value, Mo., 860.
mildew, control, N.C., 744.
milk for infants, metabolism experiments, 190.
oil meal as protein supplement for chicks, Ind., 365.
plants, nitrogen distribution at different growth stages, 520.
purple stain, notes, Ind., 342.
specimens, threshing, grille for, Ga., 778.
Soybeans—
and corn, interplanting test, Miss., 433, 435.
as national food in Italy, 586.
as source of protein for chicks, Ind., 366.
breeding experiments, Ga., 125; N.C., 725; N.J., 724; Va., 726.
chloroplast pigments development, effect of minerals, 824.
culture experiments, Kans., 125; Tenn., 127; Va., 726.
cutting tests, Kans., 125.
effect of fertilizers applied with seed, Va., 726.
feeding in definite proportions, effect on pork quality, 257.
feeding value, Ind., 664; Mo., 860; Ohio, 463.
fertilizer experiments, Ind., 329; N.C., 715; Va. 716.

Soybeans—Continued.
growth, effect of boron, N.J., 719.
growth, effect of light intensity, 324.
harvesting and combine, Va., 772.
Illini, description, Ill., 828.
in adequate supplements for pigs, Ind., 363.
inheritance of pubescence in, and relation to pod color, 723.
inoculation, Iowa, 319.
mineral deficiencies in livestock feeding, Ind., 363.
production in North Carolina, 225.
seeding experiments, Ohio, 437.
utilization in the organism, 190.
v. clover and timothy for hay, Miss., 436.
v. linseed meal for milk production, Kans., 166.
varietal comparisons, Kans., 126.
variety tests, Ind., 329; Kans., 125; Md., 823; Miss., 433; N.C., 725; N.J., 724; Va., 726.
Sparaison pilosum, notes, Mont., 153.
Spartina michauxiana, notes, Iowa, 354.
Spearmint and peppermint as farm crops, U.S.D.A., 140.
Spermatozoa of horse and rabbit, optimum pH for vitality, 821.
Sphacelotheca sorghi, notes, 539.
Sphaerotheca humuli, control, 648.
Sphenophorus maidis. (*See* Corn billbug.)
Sphingomorpha chlorea, notes, 550.
Spider bite poisoning in Kansas, 663.
Spider mite. (*See* Red spider.)
Spinach—
canned, vitamin C in, S.Dak., 92.
fertility maintenance for, Md., 622.
fertilization with synthetic nitrogen salts, Va.Truck, 736.
growth, relation to pH of nutrient solutions, 642.
mosaic and beet mosaic, reciprocal transmissibility, 45.
New Zealand, composition, 524.
paper mulch experiments, Ohio, 440.
resistant, breeding, notes, Va., 753.
spray schedule for, 753.
varieties for canning, Md., 642.
yields under ultra-violet glass, 884.
Spindle worm, notes, Iowa, 354; Mich., 450.
Spirocerca sanguinolenta, Gymnopleurus sinnatus as intermediate host of, 676.
Spiruridae, intermediate host, 676.
Spores, bacterial, thermal resistance as affected by age and environment, 214.
Spotted fever, Rocky Mountain, summary, 372.
Spray—
fluids action on containers, 343.
Long Ashton, field experiments, 356.
mixtures, adhesion, studies, N.J., 751.
residue, relation to spraying and dusting practice, 828.
residue removal from fruits, 233, 756; Idaho, 680; Oreg., 85, 44; U.S.D.A., 40.
Spray—Continued.
residue studies, Mass., 848; N.J., 784.
schedules for canners' crops, 753.
schedules for Kansas, 354.
Sprayer, compressed air driven power, Mass., 848.
Spraying—
dust. (*See* Dusting.)
equipment and materials, Kans., 141.
experiments for codling moth control, Wash.Col., 550.
systems, stationary, in West Virginia, 683.
(*See also* Dusting *and* Apples, Potatoes, *etc.*)
Sprays—
combination insecticide and fungicide, Ohio, 140.
copper. (*See* Copper.)
fish oil as adhesive for, 248.
lead arsenate, fish oil as adhesive, U.S.D.A., 356.
oil, preparation and use, N.Mex., 355.
time for application, 532.
(*See also* Insecticides, Fungicides, *and specific forms.*)
Spruce—
as source of pulpwood, Mich., 740.
black, volume determination, Minn., 740.
bud scale, notes, Mich., 450.
bud worm, host selection by, 756.
bud worm, notes, Mich., 450.
gall aphid, notes, Mich., 450.
Norway, for shelter belts, growth, Ohio, 443.
red, histological studies, 646.
tortrix, notes, Mich., 450.
white, volume table, Mich., 43.
Squash—
beetle, notes, Va., 752.
beetle, toxic spray for, Md., 656.
bug, notes, Utah, 54.
bug of economic importance, studies, U.S.D.A., 754.
bugs, control, N.J., 751.
Squashes—
and pumpkins, crossing experiments, Iowa, 339.
fruit shapes, developmental history, 429.
Phytophthora citrophthora affecting, Calif., 341.
Table Queen, inbreeding, 642.
Squirrels, red, damage to pine by, 647.
St. Lawrence waterway, 285.
Stable fly, toxic spray for, Md., 656.
Stalk borers, life history and habits, Iowa, 353.
Stallion enrollment, Ind., 261.
Standard of living, relation in farming success, 579.
Starch—
in leaves, daily ranges, 628.
strength, determination, Hawaii, 724.
transformers, new species of Rhizopus, 214.

Starches, stiffness in fabrics produced by, U.S.D.A., 497.
Starter cultures, use of citric acid and sodium citrate, 564.
Starters, casein-splitting ability, 869.
Statice heart rot, notes, 841.
Statistics, place in interpretation of experimental results, 327.
Steers—
fattening, Nebr., 857.
fattening at various ages, Nebr., 160.
fattening, summer rations for, Ill., 559.
feeding experiments, Idaho, 857.
feeding experiments in sugarcane belt, U.S.D.A., 457.
feeding in dry lot v. pasture, Ohio, 457.
winter fattening, Va., 759.
winter feeding, Ind., 664.
(*See also* Cattle.)
Stegomyia fasciata development, factors affecting, 753.
Stereum necator, notes, 50.
Sterility—
and incompatibility in fruits, 428.
in Datura and pollen tube behavior, 24.
physical basis, 258.
self, in plants, physiology, 428.
self, studies, 721.
Sterols, irradiated—
properties, 896.
relation to antirachitic vitamin, 195.
Stethorus picipes, notes, U.S.D.A., 157.
Stimulation in plants, 626.
Stink bug, injurious to citrus in south China, 753.
Stinkwort, feeding tests, 71.
Stock. (*See* Livestock.)
Stock foods. (*See* Feeding stuffs.)
Stomach worms—
in sheep and goats, Oreg., 68.
in sheep, control, 874; Mich., 469.
in sheep, control by drenching, N.C., 768.
prevention, nutrition v. treatment, Ohio, 472.
Stomata—
aperture in wilting leaves, 425.
cellophane for determining degree of aperture, 425.
movement, regulation and regulatory rôle, 121.
Stomoxys calcitrans. (*See* Stable fly.)
Stones, removal from farm lands, Minn., 774.
Storage tissue substance, exosmosis into water, 212.
Straw—
and hay, blowing stackers for, studies, 478.
mulch, effect on potatoes, Nebr., 824.
mulch, effect on tomatoes, Nebr., 833.
mulch for orchards, Okla.Panhandle, 525.
mulch v. cultivation for apple trees, Kans., 137.
Strawberries—
breeding, effect of increasing daily light period of winter, 528.
breeding experiments, N.J., 733.
effect of liming, N.C., 735.
effect of spring applications of ammonium sulfate, Ind., 337.
endotrophic mycorrhiza of, significance, 846.
fertilizer experiments, N.C., 734; N.H., 139; Oreg., 36.
hybrid, yields, Nebr., 833.
important character in, variety classification, 528.
in Florida, Fla., 739.
interplanted with blueberries, Mass., 832.
pressure tests, N.J., 734.
production, costs and practices, Oreg., 685.
refrigeration, in transit, Ill., 836.
ripening, formation of pectins in, Md., 803.
varieties, N.Y.State, 340.
varieties, cost of production, Utah, 37.
variety tests, N.C., 735; Oreg., 36.
Strawberry—
bud differentiation, studies, 234.
club manual, Ill., 489.
Lanarkshire disease, summary, 846.
leaf and stem nematode, eradication, Oreg., 44.
root louse, N.J., 754.
root rot, cause and control, Oreg., 44.
root weevil control, Oreg., 52, 53.
root weevil, notes, Utah, 54.
root worm on raspberries, Calif., 351.
Stream discharge, relation to precipitation, Utah, 75.
Streptocara crassicauda nematode in gizzard of Formosan duck, 574.
Streptoccoccus lactis, proteolytic action, 563.
Strongyloides suis, notes, 571.
Strongyloidosis intestinalis of farrow in Formosa, 571.
Sucrose content of sugarcane, effect of nitrogen, 34.
Sudan grass—
for hay, seed, and pasture, Tex., 521.
v. native grass for heifers, Okla.Panhandle, 66.
Sugar beet—
army worm in California, 854.
by-products, injurious effects on livestock, Utah, 58.
curly top disease, notes, Oreg., 44.
curly top, ecological studies, 242.
curly top, new host plants, Calif., 242.
curly top, relation to western yellow blight, Utah, 45.
curly top resistant strain, tests, Calif., 846.
curly top symptoms, Calif., 242.
curly top, thermobyetics of, 52.
damping-off, control, Mich., 445.

Sugar beet—Continued.
diseases, 346; Wis., 147.
mosaic, studies, 346.
root maggot, notes, Utah, 54.
root rot, effect of manure, Utah, 28.
water mold, studies, 236.
Sugar beets—
culture experiments, Mich., 730; U.S.D.A., 724; Utah, 27.
entry into farm economy, 884.
in Palestine, 225.
irrigation experiments, Utah, 27, 28.
manuring experiments, Kans., 126.
mechanical blocking, 331.
plowing studies, Mich., 432.
rotation experiments, U.S.D.A., 724.
seed production, N.Mex., 219.
seed, test yields, Mich., 38.
seeding rates in France, 225.
thinning, 225.
time of planting, Calif., 328.
Sugar—
in blood. (*See* Blood sugar.)
maple. (*See* Maple.)
plants of technical value in Russia, 828.
production from sugar beets, Oxford process, 881.
Sugarcane—
borer, Argentine parasites for, 250.
borer, destruction, 254.
borer egg parasites, breeding, 256.
borer in Cuba, summary, 550, 851.
borer, loss caused by, estimating, 663.
borers, parasites, 256.
breeding experiments, 29, 330.
chlorosis, notes, 648.
culture experiments, 330.
diseases, 829.
experiments in Leeward Islands, 332.
factors affecting growth and sugar content, 332.
failure, relation to insect attack, 658.
fertilizer experiments, 330, 829; La., 636.
flower and seed, development, 628.
flowering habit, pollen, and seed germination, 29.
germination, effect of low-temperature storage, 121.
germination studies, 829.
growers, entomological hints to, 658.
growth and sugar content, factors affecting, 636.
insects affecting, 658.
insects affecting in Peru, 247.
juice, quality, effect of fertilizers, 29.
mosaic in India, 841.
mosaic in Peru, 539.
mottling disease. (*See* Sugarcane mosaic.)
P.O.J., in Louisiana, notes, 225.
production in Philippines, papers on, 838.
ripening experiments, 629.
root disease, notes, 646.
Sugarcane—Continued.
roots, parasite of, 237.
spindle top or needle top in Queensland, 844.
sucrose in, effect of nitrogen, 34.
tassels, preserving for breeding purposes, 637.
top rot in Queensland, 844.
varieties, 829.
varieties in Java, 332.
variety tests, 330; La., 636; Miss., 488.
yellow stripe. (*See* Sugarcane mosaic.)
Sugars. (*See* Glucose, Sucrose, *etc.*)
Sulfarsenol and 309 treatment for surra, 73.
Sulfate content of orchard soils, changes in, Calif., 420.
Sulfate of ammonia. (*See* Ammonium sulfate.)
Sulfur—
action as fungicide and acaricide, 545.
and phosphorus, experiments, S.Dak., 20.
dioxide for treatment of grapes, Calif., 789.
dioxide in dried fruits, determination, 812.
dioxide in foods, determination, 312.
drainage, effect of lime from soil, 624.
dusts in apple scab control, cause of failure, Ohio, 151.
effect on alfalfa hay, Oreg., 20.
effect on tobacco, Conn.State, 135, 136.
in Oregon soils and losses through drainage and cropping, 210.
metabolism of yeast, 23.
mixtures. (*See* Lime-sulfur.)
rendering wettable, 648.
toxic property, 709.
toxicity tests, Ohio, 444.
Sulfur-dust mixtures, adhesiveness, Ohio, 444.
Sulfuric acid as herbicide for mustard, strength, N.H., 127.
Sulphydryl compounds, autooxidation, action of carbon monoxide, 307.
Sun altitude, relation to antirachitic effect, 391.
Sunflower stem and root, buffers of, 211.
Sunflowers as silage crop, Wis., 128.
Sunlight—
effect on growth of calves, S.Dak., 66.
effect on susceptibility of rachitic rats to infection, 595.
through glass substitutes, effect on growth in chicks, 668.
value for pigs, Wis., 169.
winter, effect on growth in pigs, 666.
(*See also* Light.)
Sunshine—
temperature, and wind, U.S.D.A., 313.
winter, source of vitamin D, Ind., 366.
Supella supellectilium as household pest in Nebraska, 546.

Superphosphate—
v. lime for different soil types, Kans., 117.
value for pastures, Conn.Storrs, 432.
Surface energy studies, Utah, 11.
Surra—
experimental, treatment, 73.
problem, zoological contributions, 660.
Swamps and forest growth, drainage, Wis., 646.
Swarthmore College, horticultural foundation, notes, 500.
Sweet corn—
breeding, Ga., 136; Mass., 838.
cost of production data, N.J., 781.
effect of close planting, Ohio, 440.
fertility maintenance for, Md., 622.
fertilizer experiments, N.J., 734.
inheritance of kernal arrangement, Ill., 25.
manufacture and distribution, Md., 388.
paper mulch tests, Mich., 37; Ohio, 440.
production, economic study, Md., 583.
variety tests, Ohio, 440.
white and yellow, variation in, Ohio, 440.
(*See also* corn.)
Sweetclover—
breeding experiments, N.J., 724.
culture experiments, Va., 726.
cutting tests, Va., 726.
disease in cattle, pathology, 72.
fertilizer experiments, Va., 716.
longer-lived, notes, Miss., 436.
pasture for sheep, Ohio, 458.
pasture v. alfalfa pasture for dairy cows, S.Dak., 66.
pollinating agents, S.Dak., 54.
resembling alfalfa, notes, Wis., 127.
roots and tops, effect on molds in soil, 510.
seed, scarified and unscarified, comparison, 225.
variety tests, Hawaii, 723; Kans., 125; Mich., 432; N.Dak., 726; N.J., 724; Va., 726.
white spot, notes, Utah, 45.
white, v. alfalfa for milk production, Kans., 167.
winterkilling, Wis., 129.
Sweetclovers, value, Idaho, 823.
Sweetpotato—
black rot, control, Miss., 445; N.J., 742.
black rot, notes, Tenn., 147.
diseases, control, Iowa, 348; U.S.D.A., 447.
mosaic, transmission, Miss., 446.
nematode disease, N.C., 447.
scurf, control, N.J., 742.
stem rot, control, N.C., 346.
stem rot, resistance to, N.J., 742.
storage rots, studies, N.C., 744.
wilt, control, N.C., 346.
Sweetpotatoes—
breeding experiments, Miss., 433; N.C., 725.
culture experiments, N.C., 725; Tenn., 127.
effect of concentrated fertilizers, N.C., 622.
fertilizer experiments, Ill., 37; Miss., 433; N.C., 725; Va.Truck, 730.
production practices, N.C., 34.
selected strains, value, N.C., 725.
spray schedule for, 753.
storage tests, N.C., 725.
strain tests, N.C., 725.
variety tests, Hawaii, 723; Miss., 433.
Swimming pool pollution, indication, Mich., 774.
Swine—
diseases, report, 70.
erysipelas, immunization and serotherapy, 874.
pneumonia, new type, notes, Calif., 370.
pox, studies, 278.
stomach parasite, description, 571.
(*See also* Pigs.)
Symbiosis—
and asymbiosis relative to orchids, 819.
summary, 720.
Symptomatic anthrax. (*See* Blackleg.)
Synchytrium endobioticum, studies, 538.
Syneda alleni on blueberry in Maine, 254.
Syneta albida on cherries, studies, Oreg., 52.
Syngamus tenuispiculum n.sp., description, 574.
Syrphus wiedemanni, notes, 549.
Systena spp. (*See* Flea beetles.)
Taeniothrips inconsequens. (*See* Pear thrips.)
Talc and other dusts, insecticidal valu 652.
Tangelo, Sampson, notes, Calif., 335.
Tangelos, notes, Calif., 341.
Tangerines, notes, Calif., 341.
Tankage—
feeding value, N.J., 762; W.Va., 163.
low protein, feeding value, Ind., 863.
protein and vitamin deficiencies for pigs, Oreg., 61.
v. fish meal as protein supplements, Ga., 161.
Tapeworms—
association with fowl paralysis, 876.
in bears, anthelmintic for, 273.
in poultry, 573; Ill., 772; Kans., 172.
Tar-distillate wash, Long Ashton, field experiments, 856.
Tariff handicaps, 284.
Tarnished plant bug—
notes, Ind., 353.
transmission experiments with virus diseases, 651.
Tarsonemus approximatus narcissi, new variety from Pacific coast, 456.

Tax legislation, 579.
Tax problems of Colorado, Colo., 81.
Taxation—
and income on farms in North Carolina, N.C., 686.
and income to owner on cash-rented farms, Ohio, 482.
and use of land in northern counties, Wis., 381.
benefits from, 579.
evaluating land for, papers on, Mo., 883.
for public schools, State systems, 287, 883.
property, factor in agricultural situation, 285.
system of Kansas, Kans., 482.
Tea—
diseases in Nyasaland, 45.
insects affecting, 657.
leaf weevil, notes, 659.
mosquito bug in Nyasaland, 658.
pests in Dutch East Indies, 658, 753.
Teeth—
defects, relation to child nutrition, 892.
effect of diet, 490.
structure, and vitamin D, 892.
Temperature—
air and soil, daily and seasonal, Calif., 418.
alternation, effect on seed germination and growth, 515.
effect on flowers, 837.
effect on milk production, N.J., 765.
effect on pollen tube growth, 214.
effects in wheat metabolism, 21.
relation to nitrogen in soils, 316.
relation to quickness of killing in treating seed, 629.
sunshine, and wind, U.S.D.A., 313.
(*See also* Climate *and* Soil temperature.)
Temperatures, bioclimatically important, 613.
Tenebrio—
molitor. (*See* Meal worm, yellow.)
obscurus. (*See* Meal worm, dark.)
Tenebrioides mauritanicus, notes, 855.
Tennessee Station, notes, 99, 200.
Tennessee Station, report, 197.
Tent caterpillar, chemical changes during life cycle, 661.
Tent caterpillars, toxicity of lead salts to, 248.
Tephrosia candida as cover crop for palms, 529.
Termites—
and termite damage, Calif., 856.
in Hawaii, 753.
in the Gold Coast, 450.
injury to buildings in Ceylon, 882.
Terracing for soil moisture conservation, Okla.Panhandle, 77.
Testes of vertebrates, seasonal modifications, 690.
Tetanops aldrichi, notes, Utah, 54.
Tetany of fasting in experimental rickets, 495.
Tetrachlorethylene—
as anthelmintic, 678.
pharmacology and toxicology, 678.
Tetracnemus—
pretiosus n.sp., description, 753.
sp., notes, Calif., 351.
Tetranychus—
pacificus, notes, Calif., 351.
telarius. (*See* Red spider.)
Texas College, notes, 500, 600.
Texas fever in cattle, 270.
(*See also* Piroplasmosis.)
Texas Station, abstracts of bulletins and circulars, 298.
Textile oils, studies, 544.
Textile research, explanation of statistical methods used in, 698.
Textiles, branded and unbranded, use, 699.
(*See also* Fabrics.)
Thamnotettix smithi, notes, N.J., 751.
Theileria—
dispar, transmission by ticks, 175.
mutans, longevity in blood of cow, 269.
Thistle, Canada—
control, Ohio, 640.
sodium chlorate for, Miss., 486.
Thread blight disease on citrus and pomaceous plants, 237.
Threshing soybean specimens, grille for, Ga., 778.
Thrips—
as carriers of fig-decaying organisms, 659.
of Hawaii, 850.
on apples, notes, Oreg., 58.
parasitism by chalcids, 450.
Thrips tabaci. (*See* Onion thrips.)
Thyrospora parasitica, notes, 345.
Thyroxine, derivatives, 202.
dl-Thyroxine, resolution, 201.
Thysanoptera of Hawaii, 850.
Thysanoptera of India, 452.
Tibicina septendecim. (*See* Cicada, periodical.)
Tick eradication, papers on, 70.
Tick paralysis and tularemia, paper on, 656.
Tick parasites, papers on, 656.
Ticks, relation to piroplasmoses of Algeria, 175.
Tiger beetles of Minnesota, key, Minn., 358.
Tile, hollow load-bearing wall, fire resistance, 281.
Tillage—
distribution of mechanical power in, 682.
machinery, Idaho, 876; Iowa, 877.
studies, Kans., 114.
tools, chromium plating on, tests Mich., 772.

lletia tritici—
development, action of temperature and soil, 348.
germination and infection, conditions for, 534.
(*See also host plants.*)
imber—
as a crop, Va., 885.
borers, control, 358.
heat sterilization, 855.
utilization of land for, in New England, 283.
wind-thrown, on Olympic Peninsula, deterioration, U.S.D.A., 143.
imbers, farm, preservative treatment, U.S.D.A., 679.
(*See also* Lumber *and* Wood.)
ime, leisure, use by farm, village, and city families, Mich., 787.
ime, use in farm homes, Nebr., 196.
imothy—
establishment, effect of seed rate, 29.
for hay seeded in wheat, times and rates, Ohio, 637.
hay v. alfalfa hay for horses, Iowa, 864.
ipburn, control, Miss., 445.
(*See also specific hosts.*)
itration of ammonia, potentiometric methods, 806.
itrations, potentiometric, electrode for, 806.
'metocera ocellana. (*See* Bud moth, eye-spotted.)
Tobacco—
animal enemies of, 548.
aphid, effect of Derris, 549.
as indicator of nutritional deficiencies, 622.
black root rot resistant variety, Conn. State, 135.
breeding experiments, 29, 330; Va., 726.
bright, production in Georgia, 136; Ga.Coastal Plain, 136.
brown root rot, cause, Mass., 844.
brown root rot, effect of fertilizers, Wis., 150.
Connecticut, soil reaction studies, 332.
culture experiments, 330.
curing experiments, 29.
curing, irrigation, and seed viability studies, 330.
cutworms, studies, U.S.D.A., 853.
diseases in Nyasaland, 45.
effect of other crops on, 332.
effect of preceding crops, Mass., 823.
failure in rotation, Mass., 823.
fertilizer experiments, 226, 330; Mass., 823; Miss., 436; Va., 638, 730.
fire curing, recommendations, Conn. State, 135.
growth, effect of boron, 719.
growth, effect of boron deficiency, 213.
high-nicotine, culture, N.Y.State, 333.
industry of New England, economic research, 283.
[illegible]

Tobacco—Continued.
insects affecting, 657.
insects in Palestine, report, 248.
investigations, Conn.State, 184.
land in Deli, vegetation of fallow, 332.
mosaic—
effect on yield and quality, 243; Md., 447.
on potatoes, 241.
rôle of *Plasmodiophora tabaci* in, 242.
tissue, intracellular bodies in, 843.
virus, properties, 540.
virus, transmission experiments, 550.
nicotine content, factors affecting, 333.
plantations in Turkey, injury from ants, 256.
production relation to soil reaction, Conn.State, 637.
research, symposium on, 832.
road-oil injury to, Wis., 150.
root rots, studies, Mass., 839.
rotation tests, Ohio, 423.
soil management and cropping systems, Mass., 823.
variety tests, 330; N.Mex., 219; Va., 726; W.Va., 136.
white veins in Turkey, cause, 856.
Tomato—
bacterial canker, notes, Utah, 45.
blight, western yellow, inoculation experiments, 243.
blossom-end rot, notes, Miss., 445.
brown spot, control, 841.
canker, notes, 841.
canning factories, organization and management, Ark., 886.
curly top resistant strains, Idaho, 839.
diseases, studies, Utah, 44.
Fusarium wilt, description, Va.Truck, 746.
Fusarium wilt, resistance tests, Kans., 146.
hybrids, yield and growth, N.H., 139.
Irish blight, control, 845.
leaf mold, control, Mass., 839; Ohio, 444.
leaf mold, control in greenhouses, Mass., 448.
leafminer, habits and description, 851.
mosaic tissue, intracellular bodies in, 843.
mosaic, two types, Utah, 45.
mosaic, virus, purification, 243.
nailhead spot during transit and marketing, 48.
plant beds, forced ventilation for, Ind., 846.
plants, composition and growth, effect of boron, 524.
psyllid, notes, Utah, 54.
quality, studies, color of different regions, 643.
Sclerotium disease, notes, 651.
spotted wilt, control, 845.

Tomato—Continued.
tetraploid seedling, genetic studies, Calif., 826.
wilt, notes, 847.
wilt resistance, notes, Miss., 445.
wilt, studies, N.J., 742.
yellows, proposed name, 248.
Tomatoes—
artificially v. naturally ripened, vitamins in, 494.
breeding experiments, Ga., 144.
buying on grade, Ind., 690.
cost of production data, N.J., 781.
culture experiments, N.Dak., 785.
December v. January sowing, Ohio, 440.
disease-resistant varieties, Utah, 87.
dusting experiments, Ind., 842.
effect of ethylene gas on, Mich., 424.
effect of manganese, Ind., 338.
effect of potassium deficiency, N.H., 116.
ethylene-ripened, vitamin C in, Wis., 194.
fertility maintenance for, Md., 622.
fertilizer experiments, Ill., 87; Miss., 438; N.J., 734; Nebr., 838; Tenn., 140.
field seeding v. transplanting, N.Mex., 228.
greenhouse, fertilizer experiments, R.I., 640.
greenhouse, mechanical pollination, 835.
manufacture and distribution, Md., 883.
paper mulch experiments, 228.
pollination experiments, N.Y.Cornell, 140.
potassium requirements, 820.
production, economic study, Md., 582.
pruning and mulching experiments, Ohio, 440.
quality, relation to outer and inner wall region, Ind., 441.
ripening with ethylene gas, Minn., 89; N.J., 784.
self-pollinating capacities of varieties, Oreg., 85.
spray schedule for, 758.
studies, Ind., 337.
top-root ratio, studies, 522.
translocation of potassium in, 239.
treated, vitamin A in, 495.
varieties, characteristics, Ga., 137.
varieties, nomenclature, Ohio, 635.
variety tests, 834; Miss., 438; N.Dak., 785.
vitamin B in, N.J., 710.
yields under ultra-violet glass, 834.
Tortrix citrana, notes, Calif., 851.
Tortrix fumiferana. (See Spruce budworm.)
Torulla tenellicola n.sp., description, 250.
Toxoptera graminum. (See Green bug.)
... *caricauda*. (See Papaya
Tracing cloth, transmission of ultra-violet light, 891.
Tractor—
cultivating study, Va., 772.
drawbar springs, shock-absorbing, studies, Calif., 376.
drawbars, substitutes for wooden breakpins, Calif., 376.
plowing outfits, types, N.C., 776.
Tractors—
garden, studies, Mich., 78.
general-purpose, requirements, 680.
general-purpose, studies, Pa., 777.
number and size for given conditions, calculating, 681.
tests, Nebr., 176.
Trade area, rural-urban, developmental study, Ill., 487.
Transpiration intensity in plants, 425.
Transportation—
charges in United States and Canada, 287.
on highways of Pennsylvania, survey, U.S.D.A., 177.
rates and facilities, 284.
Tree crops to prevent soil erosion, 41.
Tree nursery, Clearfield State Forest, 42.
Tree planting at Sheridan Field Station, results, Wyo., 443.
Tree root activities, 524.
Trees—
and shrubs of New Zealand, how to identify, 531.
chlorosis in, Idaho, 847.
coniferous. (See Conifers.)
forest, growth studies, 646.
forest, planting, 531.
forest, planting in South Africa, 581.
hardwood, growth rate, Wis., 530.
hardwood, secondary succession, ecological factors in, 531.
interior, diurnal and annual temperature changes in, 530.
nursery, dipping in melted paraffin, 525.
of Illinois, native and naturalized, 645.
of western United States, 41.
ornamental, list, U.S.D.A., 733.
pressure distribution on basal section, 530.
propagation, U.S.D.A., 441.
root systems of related species, variability, 235.
seasonal activity of cambium in, 815.
shade, community spraying for Japanese beetle, 855.
shade, fertilization, 837.
shade, insects affecting, need for research on, 548.
shelter belt, value on Iowa farms, 58
windbreak, effect on crops, Idaho, 83
Okla.Panhandle, 582.
Trematodes, nomenclature, 850.
Treponema podovis n.sp., notes, 571.
Trialeurodes vaporariorum. (See Whitefly, greenhouse.)

Trioxys curculionis, notes, Conn.State, 860.
Trichinosis, account, U.S.D.A., 471.
Trichogramma—
barathrae n.sp., biology, 854.
minutum, breeding, 256.
minutum, notes, 357, 798; Ind., 353.
minutum production and distribution, 256.
Trichophyton faviform album in calves, 870.
Trichostrongylosis in sheep, 374.
Trichostrongylus—
extenuatus, description, 374.
spp., notes., Oreg., 768.
vitrinus, description, 374.
Trichuris ovis, notes, Oreg., 768.
Trichuris, proteins of, cutaneous tests with, 174.
Triphleps insidiosus, notes, U.S.D.A., 157.
Tritoxa flexa, notes, Iowa, 353.
Trophoblast cells, differentiation in pig ovum, 632.
Truck crops—
composition, 524.
dusting and spraying experiments, Va., 753.
fertilizer experiments, Ill., 37.
region of Middle Atlantic States, 288.
True, A. C., editorial notes, 1.
Trypanolysis, zone phenomena in, 568, 569.
Trypanolytic sera, therapeutic value, 568.
Trypanosoma—
annamense, notes, 73.
equinum, studies, 568, 569.
equiperdum in cats, changes in blood in, 269.
evansi, notes, 569.
spp., behavior against prophylactic action of Bayer, 205, 569.
vivax in sheep and goats, 69.
Trypanosomiasis—
adhesion reaction, 69.
vacillation of Wassermann and Sachs-Georgi reaction, 569.
Trypoxylon albitarse, nest building habits, Conn.State, 547.
Tryptophane in proteins, determination, 807.
Tuba root, botany, cultivation and chemistry, 549.
Tubercle bacilli in milk, effect of alternating electric current on, 471.
Tuberculin—
avian, as diagnostic agent for Johne's disease, 675.
hypersensitiveness, nature, 569.
hypersensitiveness, subcutaneous lesions inducing, 569.
test reactors, no-lesion, examination, Wis., 173.
test reactors, skin lesions in, Utah, 69.
Tuberculosis—
accredited freedom from in North Carolina, 70.
avian, distribution of lesions in, Kans., 172.
Tuberculosis—Continued.
avian, infection in farm animals and man, Nebr., 869.
bovine, relation to acid-fast skin infections, 270.
bovine, transmissibility to humans, 70.
control and research work, 174.
eradication, papers on, 70.
immunization of calves against, Calif., 369.
transmissibility, infectivity, and sensitivity, 72.
vaccination of cattle with BCG, 271, 570.
Tularemia—
and tick paralysis, paper on, 656.
in man, quail as source of infection, 871.
report of cases, 269.
Tulip fire, control, N.J., 743; Oreg., 44.
Tulips, breaking, transmission of the disease, Oreg., 44.
Tung oil trees, fruit bud development, 645.
Turkeys—
experiments with, Ind., 366.
Pasteurella avicida in, Idaho, 874.
production, Nebr., 862.
raising, 669.
Turnip—
greens, vitamin C in, Ga., 198.
juice, source of vitamin C for infant feeding, 193.
Rhizoctonia rot in stored crop, 49.
Turnips—
change in ash content during storage and cooking, Kans., 190.
effect on quality of milk and butter, Oreg., 67.
preparation for market, U.S.D.A., 834.
Twins, from heredity point of view, 518.
Typhlocyba—
solani, transmission experiments with virus diseases, 651.
spp., introduction and distribution, 249.
xanthippe, notes, Ohio, 450.
Typhoid, avian. (*See* Fowl typhoid.)
Typhula graminum, notes, Idaho, 839.
Typhus, canine, possible causative bacillus, 273.
Tyrosine in proteins, determination, 807.
Udder infections, Idaho, 873.
Ultra-violet—
absorption spectra of amino acids and serum proteins, 306.
and cathode rays for inducing antirachitic activity in ergosterol, comparison, 495.
irradiation—
effect on frequency of colds, 795, 796.
for rickets, 896.
fungicidal action, 50.
of ice cream, value, N.J., 767.
v. cod-liver oil for rickets prevention, 294.

Ultra-violet—Continued.
light—
and swelling of agar-agar, 120.
effect on blood formation in pigs, 861.
effect on growth in chicks, 668.
effect on pigs, 257, 666.
effect on plants, 834.
effect on viability of foot-and-mouth disease virus, 568.
penetration through fabrics, 698.
solar, actinic measurement, 697.
transmission through tracing cloth, 391.
transmission through types of glass, 795.
transmitting glass, effect on *Digitalis*, 628.
transmitting windows, use, 94.
wave lengths, effectiveness in curing rickets, 865.
Undulant fever—
an occupational disease, 175.
cases in Poland, 372.
in man, 268, 471.
in man, relation to livestock sanitation, 70.
in United States Veterans' Hospital, Knoxville, Iowa, 268.
isolation of Brucella organism from stools, 674.
outbreak, studies, Ind., 370.
relation to *Brucella abortus* in milk, 872.
symposium, 674.
treatment with acriflavine, 872.
Unicorn plants, systematic botany of, N.Y. State, 513.
United States Department of Agriculture—
animal husbandry experiment farm at Beltsville, U.S.D.A., 457.
Bureau of Biological Survey. (*See* Bureau of Biological Survey.)
1928 yearbook, 487, 498.
Office of Experiment Stations. (*See* Office of Experiment Stations.)
Weather Bureau. (*See* Weather Bureau.)
United States Livestock Sanitary Association, proceedings, 69.
Urbanization effects on government and society, treatise, 385.
Urea tests with tobacco, Conn.State, 135.
Urocystitis haemorrhagica of native cattle in Formosa, 570.
Uromyces lilii, notes, 849.
Uromyces scillarum, notes, 849.
Ustilaginoidella oedipigera, notes, 854.
Ustilago—
crameri, control, 289.
hordei, physiology, 588.
nuda, notes, 445.
striaeformis, notes, Mass., 840.
zeae chlamydospores, germination, relation to oxygen, 818.
Ustilago—Continued.
zeae, heterothallism in, 588.
zeae. (*See also* host plants.)
Utah—
College, notes, 600.
Station, notes, 200.
Station publications, annual summary, 797.
Station, report, 96.
Uteri of ovariectomized monkeys, gross changes in, 631.
Uterus of guinea pigs, vascularity variations during oestrous cycle, 631.
Van Fleet, W., life history and activities, 530.
Vanilla in ice cream, effect of storage, Mich., 67.
Variegations, relation to nature of gene, 215.
Vegetable—
diseases, notes, Miss., 445.
fats. (*See* Fats.)
gardening. (*See* Gardens.)
oils. (*See* Oils.)
potash as fertilizer, Md., 321.
proteins. (*See* Proteins.)
weevil in San Francisco Bay region, 255.
Vegetables—
and fruits, marketing, treatise, 584.
artificial ripening, Minn., 38.
as an adjunct to farms, 884.
canned, sulfide spoilage of, Iowa, 611.
canned, vitamin C in, 295.
canned, vitamins in, Mich., 793.
change in ash content during storage and cooking, Kans., 190.
deterioration at room temperature, respiration factor in, 611.
fertilizer experiments, Colo., 136.
notes, Miss., 439.
of New York: Peas, monograph, N.Y. State, 640.
oriental, vitamin C in, 595.
shipping, containers used in, U.S.D.A., 839.
studies, Hawaii, 732.
varietal and cultural tests, N.Dak., 735.
varieties, Okla.Panhandle, 38.
vitamin in, as affected by storage, Iowa, 391.
White Mountain demand for, N.H., 885.
Vegetation—
composition in a shrub bog, N.C., 721.
of fallow tobacco land in Deli, 332.
(*See also* Flora *and* Plants.)
Velvetbean caterpillar on peanuts in the Everglades, 550.
Velvetbeans, feeding value, Ga., 161.
Venturia inaequalis perithecia production effect of fungus extract, 532.
Venturia pirina, control, 541.
Vermont Station, notes, 200.
Vermont Station, report, 96.

Vermont University, notes, 200.
Verruga peruviana, transmission by Phlebotomus, 56.
Verticillium alboatrum—
effect of pH of medium, N.J., 743.
notes, Mass., 840.
Vetch—
and oat hay, cost of production, Oreg., 685.
hairy, value, N.C., 725.
in rotation, merits, Miss., 433.
mosaic tissue, intracellular bodies in, 843.
seed, dormancy in, causes, N.Y.Cornell, 132.
vitamin C in during germination, 295.
Veterinary Research Laboratory in Philippines, work, 267.
(*See also* Animal diseases.)
Vigna catjang as cover crop for palms, 529.
Vinegars, analyses, Mich., 498.
Vines, water consumption under irrigation, Calif., 378.
Vineyards, young, planting and care, Mich., 739.
(*See also* Grapes.)
Virginia Station, report, 797.
Virus—
disease, new, of fowls in Egypt, 572.
filtrable, and Rickettsia diseases in Tropics, 269, 568, 871.
transmission by peach aphid, 549.
Viruses—
filtrable, lecture on, 741.
ultra-microscopic, infecting animals and plants, discussion, 469.
Vitaglass, efficacy in rickets prevention, 94.
Vitamin A—
action of lipochromes, 793.
and oxidation of fats and oils, 291.
association with greenness in plant tissue, 494.
chemical nature, 709.
containing fats, fluorescence, measurement, 292.
deficiency, effect on oestrous cycle of rats, 794.
deficiency in rats, effects, 292, 492.
deficient diet, effect on hens, Kans., 164.
detection, 710.
in alfalfa hay, Ohio, 456.
in canned peas, Mich., 793.
in carotin, 793, 794.
in cod-liver oil, 695, 894.
in four oriental foods, 592.
in human milk, 494.
in malt extract and cod-liver oil emulsions, 387.
in margarines, 890.
in oysters, determination, 692.
in red corn, Ind., 366.
in stored yellow corn, Ohio, 456.
in tomatoes, artificially and naturally ripened, 494.
quantitative determination, 710.
Vitamin, antineuritic—
isolation from brewers' yeast, 710.
sparing action of fat on, 92.
studies, 293.
Vitamin B—
adsorption of active factors by fuller's earth, effect of pH, 91.
biochemical studies, 890.
complex, heat-stable factor, experiments, 592.
complex in rice polishings, differentiation of factors, 92.
complex nature, Ohio, 456.
composite nature, nutritional significance, 694.
deficiency, hyperglycemia in, relation to gastric motility, 193.
deficiency in infants, 293.
deficiency in pigeons, 594.
deficiency of lactating mother, effect on young rats, 696.
deficiency, relation to cutaneous lesions in dogs, 895.
deficient diet, effect on pH of intestinal canal, 794.
factor, routine administration to infants, 593.
in avocados, 293.
in beef and pork, 890.
in bread baked with large amounts of yeast, 293.
in canned peas, Mich., 793.
in cod-liver oil, 695.
in commercial insulin, 694.
in food plants, effect of soil composition and treatment, N.J., 710.
in fruits, Kans., 193.
in germinating cereals and seedlings, 295.
in rice kept four years in carbon dioxide-filled and air-tight containers, 895.
in tomatoes, artificially and naturally ripened, 494.
nomenclature, 592.
Vitamin B_1. (*See* Vitamin F.)
Vitamin B_2. (*See* Vitamin G.)
Vitamin balance and hypervitaminosis, 297.
Vitamin C—
deficiency, relation to bowel disease, 194.
immediate physiological action, 296.
in canned spinach, S.Dak., 92.
in canned vegetables, 295.
in germinating cereals and seedlings, 295.
in legumes during germination, 295.
in oriental fruits and vegetables, 595.
in pears and peaches, Kans., 193.
in potatoes, Idaho, 896.
in sauerkraut, homemade, Wis., 194.
in tomatoes, artificially and naturally ripened, 494.
in tomatoes, effect of ethylene gas, Wis., 194.

Vitamin C—Continued.
inexpensive sources for infants in China, 193.
requirements of rats, 194.
Vitamin D—
absorption spectrum, 392.
action, Iowa, 861.
and oxidation of fats and oils, 291.
and resistance of chickens to parasitism, 474.
and soft-shelled eggs, Wis., 165.
and structure of teeth, 392.
effect on growth in pigs, 666.
excess of, toxic action, 896.
formation or destruction by irradiation of ergosterol, 695.
in alfalfa hay, Wis., 168.
in butter, standardization, 297.
in butter, variations in, 695.
in canned peas, Mich., 793.
in cod-liver oil, 695, 894.
in cod-liver oil stearin, Ind., 365.
in cod-liver oil, variations in, 695.
in eggs, effect of household storage, Wis., 195.
in excessive doses and vitamin balance, 297.
in margarines, 390.
in milk, effect of cow's ration, Ohio, 170.
in milk, variations in, 695.
in poultry, formation and function, N.J., 764.
photosynthesis by ultra-violet radiation of short wave lengths, 92.
potency, fecal pH test as measure, 94.
preparations, 93.
source from winter sunshine, Ind., 866.
Vitamin deficiency, relation to disease resistance, 495.
(*See also* Avitaminosis.)
Vitamin E—
and anemia, 297.
and oxidation of fats and oils, 291.
in a ration, destruction, 95.
in honey, 597.
in molasses, 597.
in sorghum, 597.
Vitamin experiments with poultry, N.C., 764.
Vitamin F—
and G, separation in yeast, 710.
deficient diets, effect on nervous system in rats, 495.
in rice polishings, 895.
solubility in alcohol, 592, 593.
Vitamin G—
and F, separation in yeast, 710.
deficient diets, effect on nervous system of rats, 495.
feeding in graded amounts, effect on growth, 593.
in oriental foods, 894.
in rice polishings, 895.
Vitamin G—Continued.
solubility in alcohol, 592, 593.
treatment with nitrous acid, effect, 711.
Vitamin requirements of nursing young, 696, 697.
Vitamins—
destruction by oxidation, 291.
excess of, toxic action, 896.
in cod-liver oil, utilization by cows, Wis., 168.
in fruits and vegetables, Kans., 193.
in Georgia foods, Ga., 193.
in human milk, variability, 292.
in milk, cow's and human, for infant feeding, 493.
physiology of, 193.
proposed nomenclature, 90.
proposed nomenclature, criticism, 90.
recent research on, 90.
relation to hemoglobin production in rats, 193.
review of recent literature, 694.
Vitasterols, D-, studies, 297.
Vitavose, routine administration to infants, 593.
Vitula saissetiae n.sp., description, 550.
Vocational education. (*See* Agricultural education, vocational.)
Volck oil, insecticidal value, N.J., 750.
Wagons, tractive resistance, 681.
Wahi disease in cattle, 571.
Waite Institute for Agricultural Research, South Australia, notes, 600.
Walking disease of horses, nature and cause, Nebr., 768, 869.
Wall tile, hollow load-bearing, fire resistance, 281.
Walnut—
aphid, dusky-veined, notes, 246.
aphid, European, in Oregon, 851.
blight, control, Calif., 342.
crown rot, studies, Calif., 341.
fly, black, studies, 255.
pests, notes, Calif., 350.
Walnuts—
English, new pest in California, 246.
English, production in Oregon, Oreg., 442.
Persian, yields, N.Mex., 228.
starch cycle in, Calif., 336.
Wash bottle flask, nonspattering semi-automatic, description, 108.
Washing—
bottle for gas chain measurements, description, 412.
machines for milk cans, 479.
powders, germicidal properties, 411.
Washington College, notes, 500, 900.
Washington Station, notes, 500, 900.
Wasmannia auropunctata, establishment in United States, 256.
Wasp, pipe organ, nest building habits, Conn.State, 547.
Wasps, solitary, behavior, 58.

Water—
carried for household purposes on farms, Nebr., 882.
chestnut, vitamin C in, 595.
chlorination in combating yellow fever, 854.
composition and mosquito breeding, 55.
consumption of sheep and goats, Oreg., 60.
content of leaves, relation to wilting, 627.
distilled, effect on colony formation on petri plates, 265.
distribution by spraying devices under different wind velocities, 476.
duty of. (*See* Irrigation water.)
flow around bends and bridge piers, U.S.D.A., 379.
grass in rice fields, control, Calif., 378.
ground, in Pomperaug Basin of Connecticut, 476.
ground, study, Utah, 76.
heaters, electric, for poultry, Ind., 877.
heaters, solar, studies, Calif., 375, 779.
in swimming pools, orthotolidine test for free chlorine, Mich., 411.
resources of southeastern Montana, 773.
resources of upper McKenzie Valley, Oregon, 773.
supplies of Yellowstone and Treasure Counties, Montana, 773.
supply from rainfall on valley floors, 475.
supply of Columbia River and Pacific slope basins, 177.
supply of Dakota sandstone, problems, 773.
supply of Hawaii, 177.
supply of Pacific slope basins in California, 772.
supply of Pacific slope basins in Washington and upper Columbia River basin, 773.
supply of Sacramento River Basin, California, 772.
supply of Snake River Basin, 476.
Waterhemlock poisonous to livestock, Ohio, 174.
Watermelon—
seeds, dust disinfection, Iowa, 343.
wilt, control, Iowa, 342.
Watermelons—
as sugar plant in Russia, 828.
in transit, chemical injury to, U.S.D.A., 746.
Phytophthora citrophthora affecting, Calif., 341.
Waters of Maryland, iodine in, relation to goiter, 893.
Water-soluble B. (*See* Vitamin B.)
Water-soluble C. (*See* Vitamin C.)
Waterways, Mississippi and St. Lawrence, 285.
Weather—
Bureau, report, U.S.D.A., 110.
forecasting, long-range, 416.
forecasting wheat yields from, 688.
of 1928 in United States, U.S.D.A., 110.
relation to celery heart rot, 239.
surpluses, relation to net farm incomes, 285.
(*See also* Meteorological observations *and* Meteorology.)
Webworm, fall, toxic spray for, Md., 656.
Webworms, sod, notes, Iowa, 353.
Weed killers, chemical, 227.
Weed killers, composition, Conn.State, 355.
Weed seeds buried in silo with silage, germination, Kans., 125.
Weeds—
control, 330; Colo., 136; Kans., 125; Oreg., 26.
eradication, Idaho, 823; Colo., 782.
in irrigation canals, control, 830.
insects inhabiting roots of, 548.
of Oregon, 227.
perennial, winter activity of roots, 626.
Weevils, toxicity of hydrocyanic acid for, 656.
Weil's disease in man, causative organism, 872.
West Virginia—
Station, notes, 99, 398, 600.
University, notes, 398, 600.
Whale meal, feeding value, N.C., 762.
Wheat—
aluminum in, detection, Mich., 712.
ash content, factors affecting, Utah, 409.
breeding experiments, 29, 825; Calif., 328; Ga., 125; Kans., 126; N.C., 725; N.J., 724; Oreg., 26; Utah, 27; Va., 726.
bunt. (*See* Wheat smut, stinking.)
crop, Illinois, relation to Hessian fly, 254.
crosses, growth habit and rust reaction in, 238.
crosses, inheritance in, 131, 216, 723.
culture experiments, Idaho, 823; Kans., 125; Nebr., 824; Utah, 27.
disease resistant varieties, breeding, 827.
diseases and protection, 841.
early plowing and seeding, Ohio, 481.
embryos, effect of temperature, Wis., 148.
effect of preceding sweetclover crop, Miss., 436.
farms, dry-land, horse labor costs, Oreg., 684.
fertilizer experiments, Ind., 329; Miss., 434, 436; N.C., 715; Utah, 27; Va., 716, 727.
fertilizer formulas and application rates, Mich., 880.

Wheat—Continued.
fertilizer ratio experiments, Ga., 118.
fields, insect census, Kans., 152.
field-week, program, Ohio, 34.
flag smut, varietal resistance test, 534.
flour. (*See* Flour.)
foot rot disease, studies, Kans., 145.
foot rot, notes, 649.
Garnet, cutting at different stages of maturity, 226.
genetic studies, Utah, 28.
gray speck disease, 649.
growth in auto-irrigated soils, 21.
growth period, 334.
hardiness, studies, Kans., 121.
harvesting, costs, Pa., 777.
hybrid, smut resistance in, Ohio, 445.
hybrids, milling and baking tests, 333.
hybrids, resistant to lodging, Miss., 436.
hybrids, serological ranking, 25.
in diet, place, 386.
irrigation experiments, Utah, 27.
jointworms, notes, Utah, 54.
Kansas, elevator margins and marketing costs, Kans., 186.
Kansas, marketing, Kans., 179.
Kansas, quality, factors affecting, Kans., 132.
leaf rust, control and resistance to, Kans., 146.
marketing in England and Wales, 384.
Marquis, admixtures and off-types in, 638.
Marquis, description of standard type, 830.
metabolism, temperature effects in, 21.
middlings, feeding value, W.Va., 163.
milling and baking tests, Nebr., 824.
Ohio, price, Ohio, 482.
plowing experiments, Oreg., 26.
poultry, costs, N.H., 180.
preparation of seed bed, Kans., 114.
prices and world market, N.Y.Cornell, 184.
prices at Winnipeg, weighted series of, 689.
pure lines, milling and baking qualities, Ariz., 639.
quality, factors affecting, Kans., 190.
ready for combine, moisture in, Miss., 435.
records, agricultural meteorological, 808.
rod-row, cooperative experiments, 522.
root rot, notes, 649.
roots in salt solutions, toxicity, additive effects, and antagonism, 818.
rotation experiments, U.S.D.A., 724.
rust resistance, studies, Kans., 144; N.C., 744.
rust resistant varieties, testing, Ind., 342.
rust susceptibility relation to age of plant, 46.
(*See also* Wheat stem rust.)
scab, control, Mich., 842.
Wheat—Continued.
scab, epidemic, Wis., 149.
Sclerotium disease, notes, Idaho, 839.
seed, combination cleaning and treating, U.S.D.A., 182.
seed, germination, effect of crude petroleum, 317.
seed treatments, tests, Utah, 47.
seeding experiments, Idaho, 828; Kans., 125; Miss., 435; N.Mex., 219; Oreg., 26.
seedling blight, notes, Wis., 148.
shedding of kernels as heritable character, 226.
situation, August to November, 1928, 289.
situation, world, 289.
smut, control, Nebr., 824.
smut resistant varieties, Ohio, 445.
smut, stinking, control, 584; Ohio, 642.
smut, stinking, inheritance of resistance to, Calif., 344.
smut, stinking, treating machine for, U.S.D.A., 182.
smut, studies, Kans., 145.
(*See also* Cereal smuts.)
spring, dry land culture, U.S.D.A., 724.
spring, of Canada, effect of western wheat stem sawfly, 452.
spring, variety tests, Idaho, 822; Oreg., 26; Utah, 27.
starch, stiffness in fabrics produced by, U.S.D.A., 497.
stem maggot, notes, Iowa, 353.
stem rust reactions in crosses, 239.
stem rust resistant variety, Wis., 127.
(*See also* Wheat rust *and* Rust.)
straw, effect on clay soil, Oreg., 19.
stripe rust, notes, Idaho, 839.
stubble disposal tests, Utah, 27.
take-all, notes, 345.
tillering below the crown, 220.
upland v. bottom land for, N.C., 725.
varietal comparisons, Kans., 126.
varietal-date of seeding test, Calif., 328.
varieties, Ind., 328.
varieties and classes, distribution, U.S.D.A., 638.
varieties, improved, registration, 226.
variety tests, Ind., 329; Kans., 125; Mich., 432; N.C., 725; N.Dak., 726; N.J., 724; N.Mex., 219; Nebr., 824; Va., 726; West.Wash., 29.
white, texture relation to protein in, Mich., 731.
whole, for hemoglobin regeneration, value, 589.
wild, eradication, 227.
winter—
and spring, biological differences, 829.
dry land culture, U.S.D.A., 724.
effect of date of seeding, 334.
effect of preceding crop, Kans., 126.
grazing, Okla.Panhandle, 131.

Wheat—Continued.
 winter—continued.
  hardiness, studies, Iowa, 329.
  harvest period, Iowa, 329.
  pasturing with horses, Kans., 126.
  seeding date, effect on development and hardiness, 830.
  seeding experiments, Kans., 126.
  tillage methods, Wyo., 130.
  varieties, 226; N.J., 521; Idaho, 822; Oreg., 26; Utah, 27.
 yields, analysis, 521.
 yields, effect of lime and legumes, N.C., 725.
 yields, forecasting from the weather, 688.
Wheat-rye hybrids, studies, 217.
Wheel type, effect of impact reaction, U.S.D.A., 775.
White ants. (*See* Termites.)
White fly—
 greenhouse, life history and control, 356.
 Rhododendron, notes, 357.
 toxic spray for, Md., 656.
White pine—
 blister rust, European v. North American, U.S.D.A., 51.
 investigations, N.H., 142.
 light requirements, 42.
 plantations, notes, Mich., 442.
 weevil, life history studies, N.H., 153.
Willow—
 beetle outbreak, Wis., 154.
 cuttings, rooting and callusing, 737.
 scab fungus, studies, Conn.State, 349.
Wind, temperature, and sunshine, U.S.D.A., 313.
Windbreaks. (*See* Trees.)
Winter—
 fat, seed germination studies, N.Mex., 219.
 injury to apple trees, Mich., 442.
 moth control, 356.
Wireworms, studies, N.J., 752.
Wisconsin *Station, notes*, 899.
Wisconsin Station, report, 197.
Wisconsin University, notes, 399.
Witches' broom on *Cydonia japonica*, 654.
Wojnowicia graminis, notes, 845, 849.
Women, physical development and creatinine excretion by, 191.
Women, young, basal metabolism, Ohio, 492.
Wood—
 cell walls, lignification, 815.
 decomposition by fungi, significance, 542.
 decomposition, lignin and humic substances in, 720.
 gluing, U.S.D.A., 878.
 little-used species, suitability for shipping containers, 278.
 sawing, electric motors for, Pa., 880.
 structure, research in, 530.
 (*See also* Lumber *and* Timber.)
Wood tick in *sheep, pathological conditions*, 656.
Woodlots, farm, selective cutting, U.S.D.A., 144.
Woodpeckers, nuthatches, and creepers of New Jersey, N.J., 655.
Woods burning in the South, economic loss from, U.S.D.A., 341.
Woods, North American, strength, U.S.D.A., 775.
Woods, vessel size and liability to Lyctus attack, 855.
Woody plants—
 propagation, U.S.D.A., 441.
 tracheal sap from, obtaining, 816.
Wool—
 diameter and wool shrinkage estimation, measuring improvement, 258.
 fabrics, protective value, Kans., 196.
 fiber, medullated, Calif., 698.
 fibers, studies, Calif., 393.
 industry of Australia and New Zealand, 859.
 marketing, U.S.D.A., 786.
 of Romney rams, analysis, Calif., 260.
Woolen industry, British, outline, 95.
Woolly aphid. (*See* Aphids, woolly.)
Worms, nomenclature, 350.
Worms, parasitic, embryology, Kans., 178.
Wound hormones in plants, 514.
Wrapping material, new, for grafting, 229.
Wren, house, chicken mite in nest of, 360.
Xenopsylla cheopis, notes, 543, 660.
X-ray—
 stimulation in plants, 213.
 treatment of seed potatoes, effect, 628, 827.
X-rays—
 detection of heterozygotes with, 819.
 mutations induced by, 820.
Xylocrius agassizii, life history and control, Oreg., 62.
Yams in Nigeria, insects affecting, 450.
Yeast—
 brewers', purification of antineuritic vitamin from, 710.
 effect on lactation, relation to copper, 92.
 forms from *Eutettix tenellus*, 250.
 preparations, pests in, 753.
 proteins, biological value for rats, 790.
 sulfur metabolism, 28.
Yeasts, key for, 819.
Yellow fever preventive, chlorination of water for, 854.
Yellow stripe, a chlorophyll deficiency in corn, 216.
Yerba maté, insect enemies, summary, 248.
Yesca, notes, 50.
Zenillia roseanae, notes, U.S.D.A., 57.
Zinc in vegetable foods, 388.
Zinc *requirements of plants*, 23.
Zoology, applied, treatise, 350.
Zoology, textbook, 847.
Zophodia franconiella, notes, Utah, 54.
[illegible] life history, 851.